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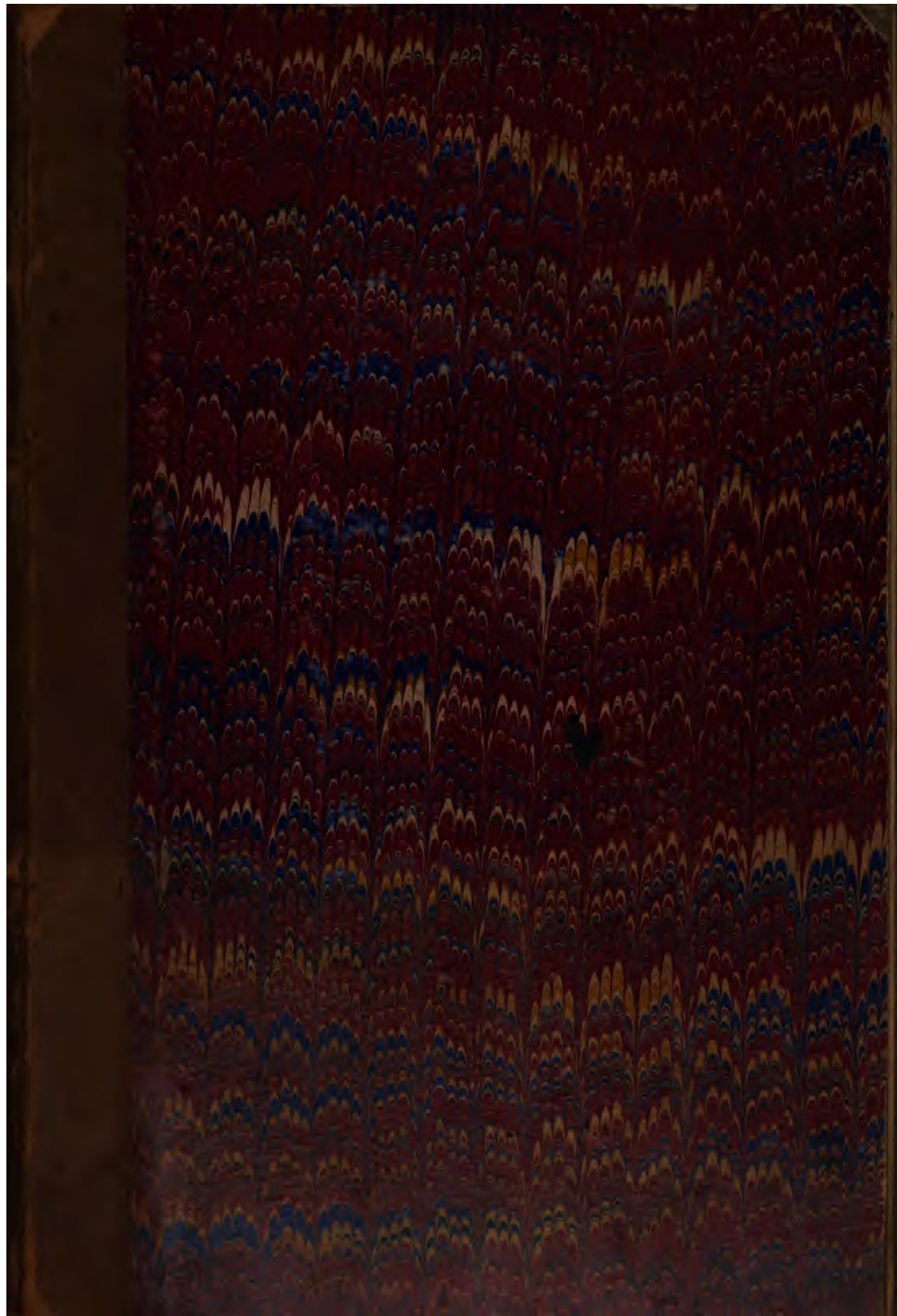
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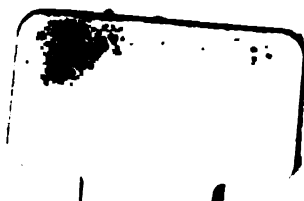
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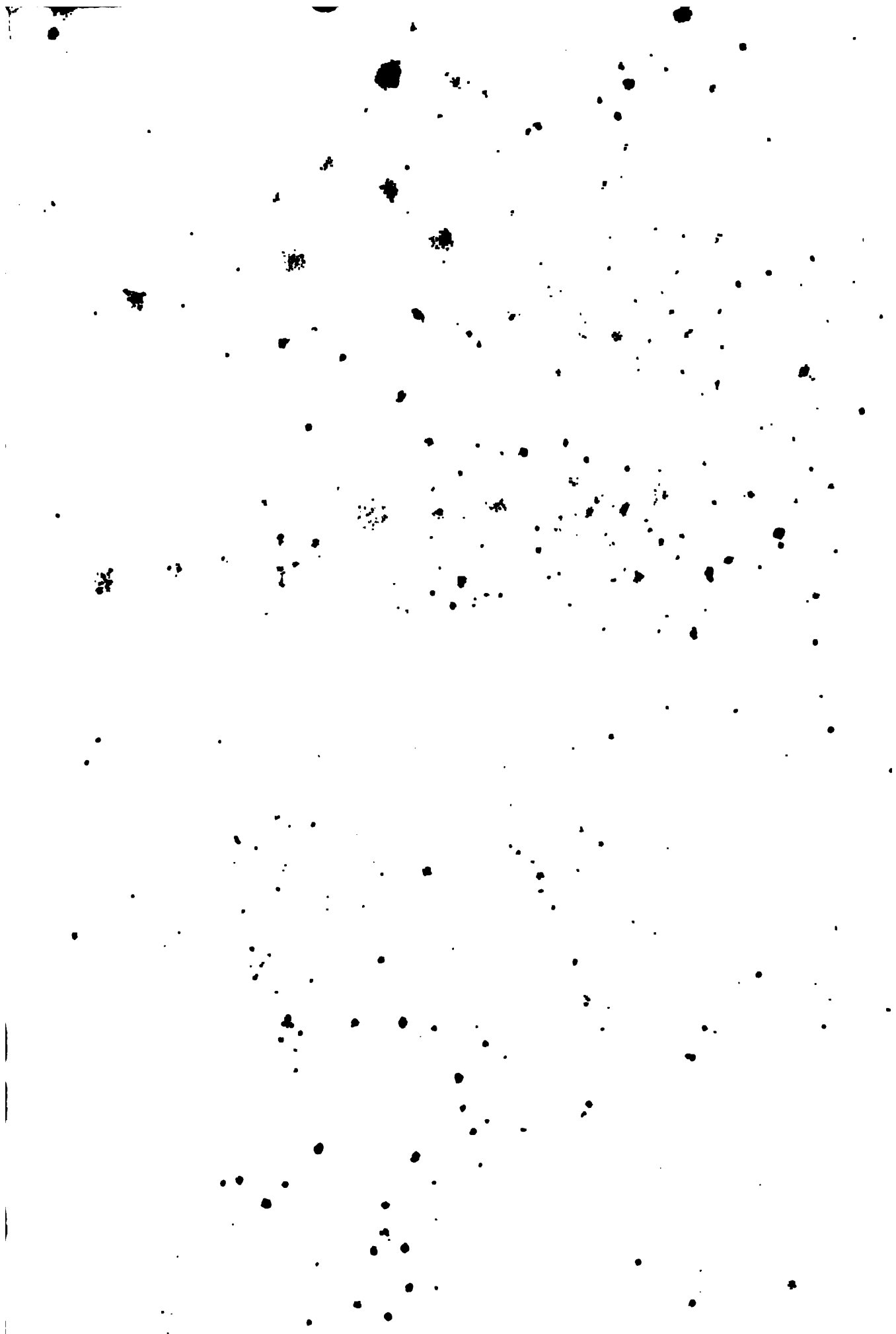
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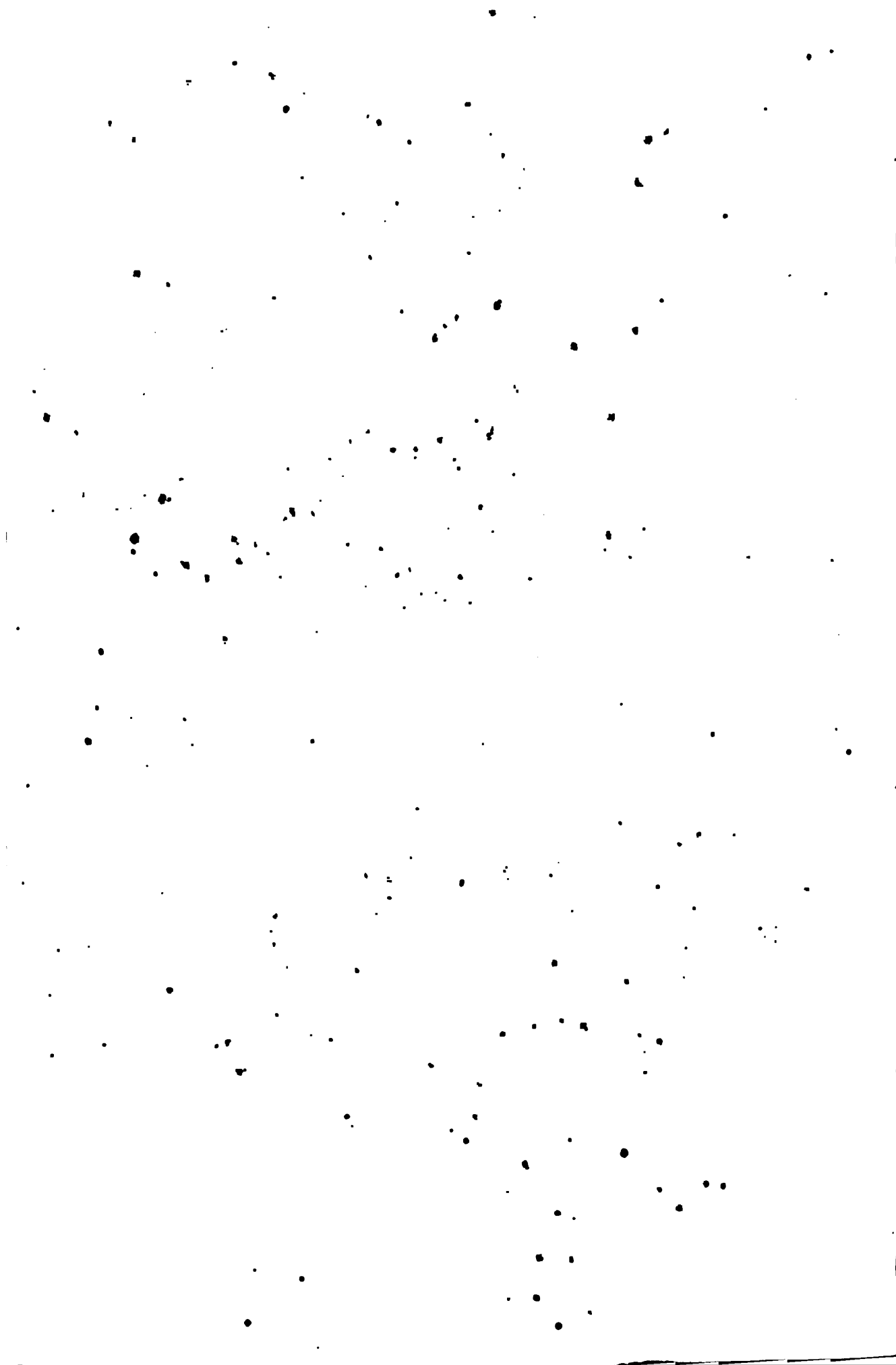




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APPENDIX TO
THE SPECIFICATIONS OF ENGLISH PATENTS FOR
Reaping Machines.



65*

176.i.96.

APPENDIX TO
THE SPECIFICATIONS OF ENGLISH PATENTS FOR
Reaping Machines.

BY BENNET WOODCROFT,
SUPERINTENDENT OF THE SPECIFICATIONS IN THE PATENT OFFICE, AND LATE
PROFESSOR OF MACHINERY IN UNIVERSITY COLLEGE, LONDON.



LONDON:
Published under the Sanction of the Commissioners of Patents,
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Printers to the Queen's Most Excellent Majesty.
1853.

176. i. 96.



TO

HIS ROYAL HIGHNESS PRINCE ALBERT,

This Work

IS, BY SPECIAL PERMISSION, MOST RESPECTFULLY

DEDICATED,

BY HIS ROYAL HIGHNESS'S OBEDIENT AND

VERY HUMBLE SERVANT,

BENNET WOODCROFT.



INTRODUCTION.

IN this Appendix to the Specifications of English Patents for Reaping Machines, as many examples on the subject have been brought together by the writer as could be collected from the sources open to research, and within the limited time allowed for its production.

It is hoped that, from the circumstance of so large a number, and such a great variety, of ingenious contrivances being displayed in one view, a cheap, simple, and effective mechanical reaping machine may be produced. In this country the want of such an instrument has been long felt; although at the present time it is perhaps more needed than at any former period, owing to foreign competition, the growing scarcity of labourers, and the consequent advance of wages.

In the year 1783, the Society of Arts distinguished itself by offering, in its list of premiums, one for an effective Reaping Machine, and continued such offer annually for a period of thirty-six years. This proposal was in the following words:—

**“ MACHINE TO ANSWER THE PURPOSE OF REAPING
OR MOWING CORN.**

“ For inventing a machine, to answer the purpose of mowing or reaping wheat, rye, barley, oats, or beans, by which it may be done more expeditiously, and cheaper, than by any method now practised—provided it does not shed the corn or pulse more than the methods in common practice, and that it lays the straw in such a manner as may be easily gathered up for binding—the gold medal.

“ The machine, with certificates that at least three acres have been cut by it, to be produced to the Society on or before the second Tuesday in December, 1783.

“ Simplicity and cheapness in the construction will be considered as principal parts of its merit.” *

In the Reports by the Juries of the Great Exhibition, at page 231, there is the following statement:—

“ At the opening of this century it was thought that a successful reaping machine had been invented ; and a reward was voted by Parliament to its author. The machine was employed here, and abroad, but, from its intricacy, fell into disuse.”

Of this and the Australian machine the writer could not obtain full information after numerous enquiries. And, it is probable, there are others which have escaped his search.

It will be matter of surprise to many that in this age and country, when machinery is made to perform the simplest and heaviest tasks, as well as the most intricate and delicate, there should still be little grain mechanically reaped. This result may be traced to many causes. Farmers generally were regardless of new mechanical aids, and in some instances even hostile to them. Now, however, they no longer reject either the help of

* See Transactions of Society of Arts, vol. i. p. 107.

the steam engine, or the benefits of applied chemistry. The time may soon be looked for when the farmer will emulate the manufacturer in the establishment of his own machine-room and laboratory.

Perhaps no single cause has led to so much attention being recently paid to reaping machines, as the wide-spread knowledge given to the public of the American apparatus shown at the Great Exhibition of 1851. The frequent notices of these implements, and of experiments made with them, by the newspaper press of the day, brought them prominently before the public. Prior to that period, many even among farmers were ignorant that any machines existed for reaping; and the public generally considered that those from America were the first inventions for the purpose.

This compilation may, therefore, not only be interesting as a branch of mechanical history, but valuable as giving, as completely as the writer can collect, the accumulated knowledge of mankind in this important department of industry; and by displaying the elementary forms of all known cutters, the combinations of all the parts forming each machine, and its mode of action, it is to be expected the machinist will no longer lose his time in re-inventing that which is already old, but by comparing all known inventions with each other, he will thereby be enabled to suggest new elementary forms of parts, new combinations, and perhaps a better mode of driving the apparatus.

To the writer a suggested improvement has occurred from the perusal of these documents, and from the reports of the press, on the great distress occasioned to horses in driving reaping machines. It will be observed that in Dobbs' machine, patented in 1814, the force for driving the cutter is derived from the hand, and not from the supporting wheels, like that of all the other animal-driven machines, having revolving or reciprocating cutters. Cutters moving with sufficient velocity

(if that be possible), when driven by the carriage wheels, require the machine to be very heavy ; it is therefore suggested that, if the cutter in Dobbs', or any other machine, were driven at a high speed* by a band, or other apparatus, from some source of power independent of the machine itself, such a machine as Dobbs', guided by a man, would then do a large amount of effective work. Power from such sources is attainable in various ways well known to machinists.

The suggestion here given may or may not be turned to practical account, it may not even be original, it is given only to show that the cursory perusal of documents containing accumulated knowledge can hardly fail to suggest some idea novel to the reader ; and as invention progresses step by step, and is the result of some improvement added to what was before known, the value of such information is too great to be duly estimated. Watt did not invent the steam-engine, nor did Arkwright invent cotton-spinning machines ; but it is well known that what they did was, first to study the defects of existing machines, and then to add improvements, which not only produced to themselves ample fortunes and abiding fame, but to the country a degree of prosperity which has no parallel in history.

In attempting mechanical improvements, the first step should be to learn what machines exist for the same purpose, and what are their defects ; and so important is this subject, that it would be well if societies, constituted for specific purposes, would undertake to collect, classify, and promulgate all information of value connected with the objects they profess to encourage. Any individual who undertakes such a task on his own responsibility, knows full well he has a profitless work in hand ; but if he possess sufficient zeal to proceed, he naturally expects aid from those for whose especial benefit

* A leaden disc made to revolve rapidly against a steel bar will cut it asunder.

he expends both time and money. In this expectation, the writer has not been disappointed; for, with the exception of the Royal Agricultural Society, all others have willingly and cheerfully given all the information in their power. That its members generally will, notwithstanding, entertain a favorable appreciation of a work like the present little doubt can be entertained.

Members of Chambers of Commerce would adopt an enlightened policy in lending their aid to extend a knowledge of the elements of invention to those from whom they expect improvements to originate.

If each Chamber of Commerce throughout the kingdom were to collect and publish all that is known on the peculiar arts over which it presides, great improvements would naturally follow. If, for instance, Manchester, Glasgow, and Belfast were to furnish all that is respectively known on the machinery for producing textile fabrics; Leicester, all that relates to hosiery; Nottingham, all that relates to lace; Sheffield and Birmingham, all that appertains to the manufacture of iron, steel, and the products from them;—then, for the first time, would the manufacturer, and the artizan, learn by what steps, of both failure and success, the machines by which they live, and at present prosper, have been constructed; and they would thereby also be guided to make such further improvements as would enable their manufactures hereafter to bear competition with those of other energetic and progressing nations.

B. WOODCROFT.


ERRATA.

A new Arrangement of the Numbers to all the Patents having taken place, the following alterations are thereby rendered necessary :—

For Nos. 2320 read Nos. 2324

2400	2404
2855	2859
2873	2877
3464	3468
3838	3844
6081	5989
8757	8668
9051	8962
9899	9812
11,436	11,346
11,984	11,907
12,988	12,907
13,476	13,398
13,912	13,836
13,985	13,910
13,999	13,924
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14,274	14,201
14,292	14,219
14,370	14,296
14,390	14,319
14,394	14,321

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"	V. Plucknett.	"	XVI. Gladstone.
"	VI. Clover Reaper.	"	XVII. Garrett.
"	VII. Salmon.	"	XVIII. Mason.
"	VIII. Smith.	"	XIX. Wray.
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APPENDIX TO ENGLISH PATENTED REAPING MACHINES.



THE Sickle is an instrument for reaping of great antiquity. We find it mentioned in the Bible and New Testament, in the following passages:—*Deuteronomy* xiii. 24, 25; *Isaiah* xvii. 5; *Jeremiah* i. 16; *Revelations* xiv. 15, 16. From the statement in *Isaiah* it may be inferred that it was used in the hand only, and not as part of a machine. That this was also the case in Egypt is evident from the bas-reliefs upon some of the buildings and tombs, (as delineated in the *Description de l'Égypte*, published by order of Napoleon) where reapers are represented using sickles, some with smooth and others with serrated cutting edges. Two of these ancient Egyptian iron sickles, much oxidized, with smooth cutting edges, are displayed in the lowest compartment of cases 33-35, in the Gallery of Egyptian Antiquities, in the British Museum. One of them was found by Belzoni, under a statue at Karnak.*

A Chinese Encyclopædia in the library of University College, London, has been examined, to ascertain what means are used for reaping by that ingenious people. The sickle and the scythe are the only instruments shown.

The first account of a *Machine* to reap grain, appears to be that given by Pliny the Elder, who was born, it is thought, A. D. 23. He says:—

* Sixteenth Edition of the Synopsis of the Contents of the British Museum, page 207.

Messis ipsius ratio varia. Galliarum latifundis valli prægrandes* dentibus in margine infestis, duabus rotis per segetem impelluntur, iumento in contrarium iuncto: ita directæ in vallum cadunt spicæ. Stipulæ alibi mediæ falce præciduntur, atque inter duas mergites spica distringitur. Alibi ab radice vellunt; quique id faciunt, proscindi ab se obiter agrum interpretantur, cum extrahant succum. Differentia hæc: ubi stipula domos contingunt, quam longissimam servant; ubi fœni inopia est, stramento paleam quærunt. Paniculi culmo non tegunt. Milii culmum fere inurunt. Hordei stipulam bubus gratissimam servant.

Panicum et milium singulatim pectine manuali legunt Gallie

Messis ipsa alibi tribulis in area, alibi equarum gressibus exteritur, alibi perticis flagellatur. Triticum, quo serius metitur, copiosius invenitur; quo celerius vero, hoc speciosius ac robustius. Lex apertissima antequam granum indurescat, et cum iam traxerit colorem. Oraculum vero, biduo celerius messem facere potius quam biduo serius. Siliginis et tritici etiam ratio

There are various methods of reaping. In the extensive fields in the lowlands of Gaul, vans of large size, with projecting teeth on the edge, are driven on two wheels through the standing corn by an ox yoked in a reverse position. In this manner the ears are torn off, and fall into the van. In some places the stalks are severed in the middle by a sickle, and the ear is stripped off between two hatchels. In other places they pull them up by the roots; and those who adopt this method maintain that they thus loosen the soil as they proceed, and at the same time extract the moisture. The reason of this difference is, that where they thatch their houses with straw they cut it as long as possible; where hay is scarce they require the short straw for litter. The panic stalk is not used for thatch; that of millet is generally burnt. The barley straw they keep as the favourite fodder of oxen. The Gauls gather panic and millet ear by ear with a hand comb. The grain itself is separated in some places by means of drags on a thrashing floor; in others by the tread of horses; and in others it is thrashed out with flails. The later wheat is reaped, the more abundant is the yield; but the earlier, the finer and stronger is the grain. The most convenient rule is — reap before the grain hardens, and as soon as it has acquired its proper color; but it is a maxim of oracular truth that “’tis better to reap two days too soon than two days too late.” The treatment of wheat and corn on the threshing floor and in the granary requires attention! Barley, since

* The word *valli*, employed by Pliny with the epithet *prægrandes* in this passage, is, in all probability, the diminutive of *vannus*, a “winnowing van.” Pliny describes the peculiar form of this cart by a reference to a well-known agricultural implement.

in area horreoque. Far,*
quia difficulter excutitur,
convenit cum palea sua
condi, et stipula tantum
et aristis liberatur.

PLINY'S *Nat. Hist.*
L. xviii. 72.

As Palladius (an Eastern prælate and ecclesiastical writer, who was born A.D. 391) gives a similar account of this machine in the following words, it is probable that its use was uninterruptedly continued through centuries.



Pars Galliarum planior hoc
compendio utitur ad meten-
dum, et præter hominum la-
bores, unius bovis opera spa-
tium totius messis absumit.

Sit itaque vehiculum, quod
duabus rotis brevibus fertur.
Hujus quadrata superficies
tabulis munitur, quæ forin-

In the Gallic lowlands they employ a more expeditious method of reaping, requiring, in addition to the labour of men, the assistance of a single ox during the whole harvest time. A cart is constructed which moves on two short wheels. The bottom of it, which is rectangular in form, is protected

* The word *far*, is applied to breadstuffs of various kinds, both in the grain and when ground. From the allusion to the *aristæ*, it is probable that barley is here intended.

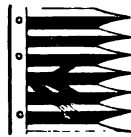
secus reclines in summo red-
dant spatia largiora.

Ab ejus fronte carpent
brevior est altitudo tabula-
rum. Ibi denticuli plurimi ac
rari ad spicarum mensuram
constituuntur in ordinem, ad
superiorem partem recurvi.
A tergo vero ejusdem vehi-
culi duo brevissimi temones
figurantur velut amites bast-
ernarum. Ibi bos capite in
vehiculum verso jugo aptatur
et vinculis, mansuetus sanè,
qui non modum compulsoris
excedat.

Hic ubi vehiculum per
messes cœpit impellere, omnis
spica in carpentum denticulis
comprehensa cumulatur ab-
ruptis et relictis paleis.

Altitudinem vel humilita-
tem plerumque bubulco mode-
rante qui sequitur; et ita per
paucos itus et reditus brevi
horarum spatio tota messis
impletur. Hoc campestribus
locis et equalibus utile est, et
iis quibus necessaria palea
non habetur.

at the sides by boards sloping outwards, so
that the upper part of the vehicle is wider
than the lower. The boards in front of the
cart are lower than the rest. At that part
a great number of teeth, curved upwards, are
arranged in a row at intervals adapted to
the size of an ear of corn. Behind this cart
two very short shafts are fastened like the
poles of sedan chairs. To these an ox is
yoked and harnessed, with his head turned
towards the cart. The animal must be well
broken in, so as not to exceed the driver's
pace. When he proceeds to drive the vehicle
through the corn, all the ears are caught by



the teeth and fall in a heap
into the cart, the broken stalks
being left behind. The driver,
who follows, generally regulates
the elevation or depression of the
teeth; and thus, by a few courses backwards
and forwards, the whole crop is gathered in
the space of a few hours. This system is
useful in open level places, and in those
where straw is not absolutely wanted. PAL-
LADIUS, *Lib. vii. Tit. 2.*

Until a recent period no authentic account has been found of
any plan of mechanical reaping, except that of the Gauls already
described; and the time when such machine fell into disuse is not
recorded.*

In the Psalters and other Manuscripts of the Middle Ages, reaping

* The above translations and wood-cuts were made for this work. Other translations,
and drawings suggested from them, have appeared; but that part of the apparatus for sepa-
rating the ears of grain from the straw has invariably been shewn incapable of producing
that effect from the form and distance of the teeth.

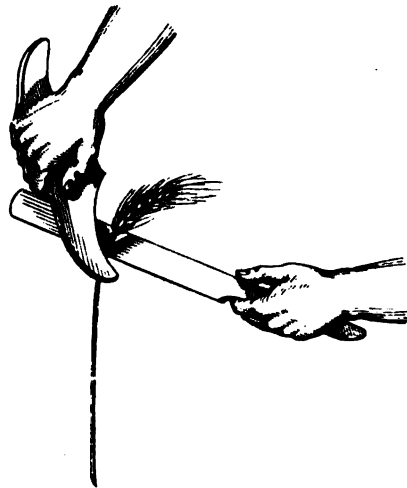
See *Annales des Arts et Manufactures*, by M. Le Normand, vol. xl.—Comte de Las-
teyrie's *Collection de Machines, d'Instruments, &c.*, vol. ii. p. 99.—Borgnis' *Traité
complet de Mécanique appliquée aux Arts*, vol. v. p. 94.—Philemon Holland's Trans-
lation of Pliny's Natural History, Eighteenth Book, chapter xxx.—Loudon's Ency-
clopædia of Agriculture, p. 25.

is represented as performed by labourers with sickles, as described in Biblical history, and as is the case generally at the present day.

In Java an instrument is used for reaping grain, which is described as follows, in the second edition of the History of that Island, by Sir Thomas Stamford Raffles, at page 125 of the 1st vol. :—" The *árit*, or weeding-knife, costs about eight pence ; and the *áni áni*, with which the grain is reaped, about three pence. The latter is a small instrument of peculiar shape. The reaper holds it in a particular manner, and crops off with it each separate ear, along with a few inches of the straw. This mode of reaping has been immemorially practised, and is universally followed. Some of the most intelligent people being questioned respecting the origin of this operose process, answered, that it was reported to have been established in ancient times as a *s'lámat* or grateful acknowledgment for an abundant harvest ; that when his field was covered with the bounty of Ceres, no reaper could refuse her this acknowledgment, and that the religious discharge of this obligation was guarded by the belief that if he ceased to offer this tribute of his labour at the season of harvest, the field would not continue to yield him the same abundant return." The wood-cut here given is copied



from the drawing of the instrument as represented in Plate VIII. of the work before mentioned. From this description of the *áni áni* being so vague, it is difficult to form a correct opinion of the manner in which it is used ; and the drawing does not remove the doubt. It is conjectured, however, that the reaper takes one of the two parts in the right hand and the other in the left ; and that in passing them like the blades of shears over each other the straw between them is cut asunder ; and by the same act the head of grain is thrown into a basket or apron worn by the reaper. In illustration of this view the accompanying wood-cut is given.



The earliest proposal for a mechanical reaping machine in Britain appears to be that described in the *Annals of Agriculture*, and other useful arts, collected and published by Arthur Young, Esq. F. R. S. &c. In vol. iv., page 205, of that work, published in the year 1785, appears the following letter :

ON A MACHINE FOR REAPING CORN.

By Capel Lofft, Esq. of Troston Hall, near Bury.

“ DEAR SIR,

“ The Society for the encouragement of Arts, Manufactures, and Commerce, having, in the year 1780, proposed the gold medal, or thirty pounds, as a premium for a machine to answer the purpose of mowing or reaping wheat, rye, barley, oats, or beans, by which it may be done more expeditiously and cheaper than by any method now practised—provided that it does not shed the corn or pulse more than the methods in common practice, and that it lays the straw in such manner as may be easily gathered up for binding.—I was surprised by your telling me that a machine, adapted in part to the same views, is described in Pliny and Palladius. You pointed out the passages, which I translated. The result is annexed. I leave it to your judgment, and that of others conversant in the theory and practice of Agriculture, whether it would not be practicable to give the last requisite of the Society’s proposal to this very machine ; and whether its simplicity and convenience would not sufficiently correspond to the two other points demanded, that of reaping with more cheapness and expedition than by any present method, and of not losing more grain than in the common way. As for the cheapness of the instrument itself, I imagine that is obvious ; and also that if it should be thought worth the while, any person used to drawing plans of this kind, might easily give a draught by which any workman would presently make the instrument : which, indeed, the teeth excepted, differs little from a large wheel-barrow, as Holland calls it. Yours, &c.

“ August 17, 1785.

“ CAPEL LOFFT.

“ TO ARTHUR YOUNG, ESQ.”

[Here follow the extracts from Palladius and Pliny, with translations of the same, and notes, by Mr. Lofft.]

Mr. Capel Lofft gives the following account of the locality in which he resides.

“ The living of Troston is in the Crown. The manor was formerly, as many others, appendant to the Abbacy of Bury. Consists of 28 houses. Agriculture is almost the sole employ. Have resident neither butcher, baker, nor barber; divine, surgeon, nor apothecary; nor, till I imported that evil, a *lawyer*.”

In vol. viii. of the Annals of Agriculture, (published in 1787,) there appears at page 161, the following account of a machine for reaping corn, (see Plate I*.)

MACHINE FOR REAPING CORN.

By Mr. William Pitt, of Pendeford.

“ In pursuance of the idea contained in Mr. Lofft’s translation from Pliny and Palladius, vol. iv. p. 205, the enclosed drawings are designs for a machine for reaping, or rather rippling corn in harvest by an horse or ox. The farther prosecution of this idea is earnestly recommended to Mr. Winlaw, as preparatory to his rubbing mill; as, were it brought to perfection, the business of rippling being cheaply and expeditiously done in the field, the corn is rendered fit for the rubbing mill, without farther preparation. Fig. 1. Section of the machine to be pushed forward by an horse or ox. As the machine goes forward, the wheel A, gives motion to the pulley B, fixed on the same centre, and by means of the band C, to the pulley D, and tooth wheel E;—which latter gives motion to the pinion F, and rippling cylinder G,—the rippling cylinder going round twice for the wheel A, once, and its iron combs or teeth, rippling off the ears of corn in rotation, let them fall into the small car H, from whence a man with a prong or shovel is to remove them into the great car K, which being filled, the beast may be turned the contrary way, and the whole drawn to the store-rooms.

“ The grain thus collected in a short time of the most favorable weather, the straw may be cut and collected at leisure, and with less regard to rain or showers than is necessarily the case in the common mode of harvesting.

“ Fig. 2. Plan of the machine,—the same letters referring to the same particulars as before.”

W. P.

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In a work published in the year 1799, under the title of "A System of Familiar Philosophy in Twelve Lectures," by Mr. A. Walker, there is a description of a reaping machine, illustrated by a drawing, as shown in Plate I.

There is no statement by whom or at what period this machine was invented, but it was certainly before the publication of the book in which it appears; neither is there to be found any account of the machine having been made and worked. The description is as follows:—

"The reaping machine is actuated by a horse, and may be useful when corn is full ripe and hands cannot be procured to reap it.

Fig. 3, is a ground plan of the machine, and Fig. 2, its elevation. The bottom plate *a*, is of strong sheet iron to which is welded or rivetted the steel points *c, c, c*, each of which has a sharp edge on the sides *x, x*. The wheel *s, s*, is of iron and has seven knives fixed upon it, their cutting edges at *g, g*. This wheel with its knives is put in circular motion by the pulley *n*, fixed on its axle between the two plates *a*, and *d* (see the elevation). This pulley has motion given to it by the cord *m, m*, which goes round the wheel *z, z*; and the wheel *z*, has a pinion *i, i*, on its axle, whose teeth conform to the cogs of the perpendicular wheel *q, q*. The wheel *q, q*, is on the axle of the two cart wheels *k, k*; and these are put into motion by the horse, which pushes the machine forward at his breast, as in mills that are actuated by horses. The steel points *c, c*, are pushed into the corn, and serve not only to hold it fast while cutting, but their sharp edges *x, x*, become half a pair of shears or scissors, and the circulating knives the other by which the corn is cut, and falling on the platform *s*, is swept by the rod *u*, (fixed on the axle of the wheel *n*,) off the platform and laid out of the way of the cart-wheel, so as to be easily bound up into sheaves. But when the machine returns, the lever *u*, would throw the cut corn among the standing corn, it must, therefore, be taken out of its socket and the rod *w*, put in its place, the point of which, *o*, stands perpendicularly and catches, every revolution, a lever or rod, turning on the fulcrum *p*, and sweeps off the cut corn, laying it like a swath on the side already cut. This lever ought to have a spring to bring it back when disengaged from the pin *o*, and a joint or hinge to prevent its sweeping the cut corn the wrong way. The single

wheel *r*, is to support the forepart of the machine and may be fixed higher or lower, so as to make the stubble short or long. A semi-collar is made to fit the horse's breast, and so fixed that he may be easily disengaged. A boy may turn and manage the machine.

"The drawings of this machine are on a scale of an inch to a foot. A horse will cut a swath two feet wide as fast as he can walk, or rather more than could be reaped in the same time and in the usual way by six men."

On the fourth of July, 1799, the first Patent (No. 2320) for a reaping machine was obtained by Joseph Boyce, of Pine Apple Place, Marylebone; and in the following year Letters Patent (No. 2400) were granted for a mechanical reaper to Robert Meares, of Frome, Somersetshire, on the twentieth of May. As no illustrative drawing was appended to Meares' Specification, the two figures in the accompanying Plate II., have been prepared from the written description to supply that deficiency.

Letters Patent (No. 2855) were granted to Thomas James Plucknett, of Deptford, for a reaping apparatus, on the fifteenth of June 1805; but as the Patentee omitted to enrol a Specification, these Letters Patent became void.

Mr Plucknett obtained a second Patent (No. 2873) on the twenty-third of August, 1805, and enrolled a Specification to the same, but without a drawing of his machine. The three views of the machine in the accompanying Plate III., have been, therefore, prepared from the written account; but in this case, as well as in that of Meares', the drawings have been made from the description, and do not form a part of the original Specification.

In 1806, Mr. Gladstone produced a reaping machine having an arrangement of parts for gathering the cut corn and delivering it in small sheaves. The following description of the machine appeared (with the drawing in Plate IV.,) in the *Edinburgh Encyclopædia*, vol. i. p. 262:—*

"The aid furnished to husbandry by mechanical invention has been already noticed; but many people have deemed it practicable to extend that aid to one of the most important branches of rural

* This machine is also noticed in Loudon's *Encyclopædia of Agriculture*, at p. 427.

economy,—namely, that of reaping corn, which, at the current rate of labour, is become a most expensive process: this desideratum, however, has not hitherto been obtained, though several unsuccessful attempts have been made by ingenious artizans to construct an implement capable of executing the reaping process. One of these implements has been constructed by Mr. Gladstone, at Castle Douglas, and though found imperfect upon trial, may probably have laid the foundation of a more successful attempt at some future period. * * *

“ Without further preamble we proceed to describe Mr. Gladstone’s machine. A, A, are the shafts, in which a horse is yoked; B, B, are two wheels, which support the machine, and, revolving upon the ground when the horse goes forward, give motion to the machine. Upon the axle C, of the wheels, the large cog-wheel D, is fixed, acting in the pinion E; upon the axle of which is fixed the breast-wheel F, and the pulley G.

“ The breast-wheel F, by acting in the pinion R, gives motion to the breast-wheel H. The cutter K, is fixed on the lower end of a spindle, coming up through the middle of the iron bar L, L, L; and upon the top of this spindle the small pinion M, is fixed, which acts in the breast-wheel H. The pulley G, by means of a pitch-chain, sets in motion the small pinion N, which acts in the large gathering wheel O; and on this wheel the large cross-arm P, P, is fixed, to the end of which the gatherer Q, is attached, with another gatherer at the end of it, if found necessary.

“ The gathering-wheel O, with its cross-arm P, P, and gatherer Q, revolves round the cast-iron bar L, L, L, as its centre or axis. It is evident, when the machine is drawn forward, the cutting wheel K, will be put into a very rapid motion, while the gathering apparatus will go comparatively slow. S, S, is a circular table of wood, with strong wooden teeth, notched below all around, in front of it. The table is fixed upon the cast-iron bar L, L, L; and, as the cutter works immediately below, or rather betwixt the wooden teeth, as may be seen at T, they not only hold the corn from flying the cutter, but prevent it being hurt or damaged; and the table serves to support the corn when cut, till the gatherer comes round.

“ W, is a spindle through the cross arm P; a tail V, is fixed to the bottom of it; and the gatherer Q, fixed to the top of this spindle, has

liberty to turn backward and forward upon it as a centre. *w*, is a segment of wood, by which the tail and gatherer are supported. This tail keeps the gatherer in its proper position, until it comes round below the large cross-beam *x*. A piece of wood is fixed below this beam, which takes the corn out of the gatherer, and leaves it in small sheaves, or handfuls. This it does easily, as the tail of the gatherer being no longer supported by the segment of wood *w*, the gatherer falls back, and continues in the position as at *m*, till it comes round to *n*, when the tail rests on the piece of wood *w*, and brings the gatherer again into its proper position. The gatherer can be let out and taken in as necessary, by means of the slide groove seen at *w*. *a, a*, are small circular pieces of wood, coated with something that has a tendency to make iron sharp by rubbing upon it; but the name thereof I have forgotten. These circular pieces of wood are put into a rapid motion by the rope *b*, over the pulley *c*, and *d*; they are so constructed as to be put in motion and stopped at pleasure, without interrupting the progress of the machine. They also sharp the outer edge of the cutter. *w*, is a small handle, which turns a screw, that sets the pinion *e*, out of the large cog-wheel, and admits the machine to be drawn as easily as a common cart, without putting the machinery in motion. *g, g*, are two handles, by means of which the cutter can be made either to cut low or high, as circumstances may require. Fig. 1, gives a side view of the machine; Fig. 2, a horizontal view of it: Fig. 3, is a view of the cutting-wheel by itself, with separate cutters or scythes, bolted to it, as at *n, n, n, n, n*; Fig. 4, is a view of the cast iron bar *L, L, L*; and Fig. 5, is a view of the cutting-wheel. I am well aware of the difficulty which attends a description of this nature, and how imperfectly it may be understood by the great body of those who are interested; but if I have made myself intelligible to mechanics, or such cultivators as are tolerably well acquainted with the first principles of the art, my object will be completely gained.

“ We may add that, several years have elapsed since Mr. Gladstone constructed the main parts of the machine we have attempted to describe; and, about two years ago he made a model thereof, which was mentioned to the Highland Society by Sir Alexander Gordon, Bart. That respectable body at first seemed anxious that Mr. Gladstone should construct a complete machine, so as its powers and uses

might be sufficiently ascertained ; but latterly, for reasons best known to themselves, their support has been withdrawn ; and the design likely would have been given up, had not a public-spirited gentleman, Sir Edward Crofton, happened to see the model, and ordered one to be made on his account. This machine has been greatly improved by Mr. Gladstone, who has favored the Editor with a drawing of his improved machine, which we shall give under the article 'Reaping Machine,' where we shall have an opportunity of discussing this subject at length, and of describing the ingenious reaping machine recently invented by Mr. Alexander Scott, of Ormiston, which has met with the approbation of the Dalkeith Farming Society, 1830."

A short notice of a machine made by Mr. Plucknett was published in 1807, in the Farmer's Dictionary, vol. ii. under the head "Reaping Machine," and a side elevation thereof, appeared in Plate XXIII., No. 1, of that work ; but this machine is not constructed according to the description given in the Specification. Plate V. contains a copy of the drawing of the machine, and Plate VI. of one for reaping clover,* which also appeared in Plate XXIII. The following is the account referred to :—

"REAPING MACHINE.—A contrivance for the purpose of reaping grain by means of animal labour. With this view, and to facilitate an operation of such importance to the Farmer, different attempts have been made to construct machines, so as to dispatch the work in a rapid manner by the assistance of horse labour ; but the success with which they have been attended, has hitherto been far from complete. An implement of this sort has lately been made by Mr. Plucknett ; it is upon a somewhat new principle, the horse drawing the machine instead of pushing it forward, as was the old mode of applying the power.

* There is no description of the clover reaper in the Farmer's Dictionary ; but in London's Encyclopædia of Agriculture, at p. 427, it is shown, accompanied by the following explanation :—

A machine for reaping the heads or seed-pods of clover, (Fig. 379,) where the second growth of that crop is left to stand for seed, has been used in some parts of Norfolk and Suffolk. It consists of a comb, the teeth of which are lance-shaped, very sharp, and set close. This comb is affixed horizontally to the fore part of the bottom of an open box or barrow, which is drawn by one horse, and guided by a man, who empties the barrow in regular lines across the field by means of an implement (a) which serves also to clean the teeth.

"In this machine the horse tracks from the front side of it, which is seen at Fig. 1, in Plate XXIII., so as to be clear of the crop; the large wheels, by the axle, drive the wheel *a*, which communicates with the wheels *b*, and *c*, the latter of which is found in the axis of the cutter *d*, a man at the handles regulates the direction, &c."

In the second half of Plate XXIII., (Farmer's Dictionary) there is delineated a reaping machine designed by Mr. Salmon, of Woburn; but the description given of it is confined to the notes or references upon that Plate.* This machine (which is fitted with an apparatus for gathering the cut corn and laying it in swathes) is represented in the accompanying Plate VII.

The next persons who appear to have directed their attention to this subject were Messrs. Kerr, of Edinburgh, and Smith, of Deanston, whose reaping machines were employed in the harvest of 1811. The two implements were similar in principle; and the priority of the invention was claimed by each party. Descriptions of Smith's machine have been published from time to time in various works. The following extract (with the accompanying Plate VIII.) is from the *Encyclopædia Edinensis*, vol. i. p. 135.†

"Fig. 1, Plate IV., is a perspective view of Mr. Smith's reaping machine. *A, B*, is the frame-work which supports the cutter *D*, and the machinery by which it is put in motion. *C*, is a conical drum, made of tin plate or basket-work, two feet deep and about five feet diameter at its lower part, to which the circular cutter *D*, is attached. The drum is covered on the outside with canvass, and perpendicular pieces of soft rope, about an inch thick, and three or four inches distant from each other, are stitched upon it, to increase the friction in carrying round the cut corn. The circular cutter *D*, consists of six segments, which are secured in their place by screw-nails, and can easily be taken off to be sharpened; they are made of German steel, and project five inches beyond the lower part of the drum. The motion is communicated to the drum and cutter by the wheels *E, E*, through the intermediate action of the horizontal shaft *F, F*; and this latter puts in motion the upright shaft to which the drum and cutter are attached. The

* See also Loudon's *Encyclopædia of Agriculture*, p. 422.

† See also *Encyclopædia Britannica*, 7th Edition, vol. ii. p. 270 & 350.—*Oxford Encyclopædia*, vol. i. p. 154.—Loudon's *Encyclopædia of Agriculture*, p. 422.

horses which propel the machine are yoked to a transverse bar, which is fixed at the extremity of a pole, running back from the frame of the carriage; and they draw by means of common plough chains, directly from the cross-bar or swingle-trees. The back weight of the carriage is supported on common cart saddles, with an apparatus similar to that used in curricles.

“Operation.—An inspection of the figure will show that the carriage wheels, by a series of wheels, pinions and shafts, communicate, in proceeding forward, a rapid rotatory motion to the drum and cutter; and as the cutter projects beyond the carriage wheels on each side, a sufficient breadth is cut down to permit the carriage and horses to pass along without injuring the uncut corn. The corn is cut by the rapid motion of the cutter; and as the lower ends of the stems rest upon the edge of the cutter, and the heads come in contact with the drum, the whole is carried round, and regularly laid by the side of the machine. The lower extremities take the ground first, the heads fall outwards, and the stalks are laid parallel to each other, and nearly at right angles to the line of motion of the machine. The man who drives the horses walks behind, and guides the whole machine by the end of the pole. By a particular apparatus he can raise or lower the cutter when any obstacle comes in the way, or in going from one field to another.

“The cutters require to be sharpened four times in reaping an acre; and this operation is performed in two minutes, with a common scythe stone.

“When the machine is to be removed to a distance, the upright spindle, with the drum and cutter attached, is taken from its place, and secured on the top of the carriage. The cross-bar at the extremity of the pole is removed, and fixed in a mortice near the frame of the carriage, and the horses are turned to draw from it, so that the machine may travel to any distance, and over any kind of road.

“In the trials that have been made with Mr. Smith’s machine, it appears that it is capable of cutting down an English acre of corn in the hour; during which the cutter, as already mentioned, requires to be sharpened four times. The expense of a machine of this description is calculated at £30 or £40 sterling; but it is supposed, with proper care it may be kept in use for many years; the only

additional expense will be a new set of cutters every second or third year. Mr. Smith made the first trial of his machine on a small scale, during the harvest of 1811; and it was then wrought by two men. In 1812, he constructed a machine upon a larger scale, wrought by a horse. Several acres of oats and barley were cut down with considerable ease. It was found that the power of a single horse was unequal to push it forward on rising ground. During this harvest Mr. Smith exhibited his machine in operation, in the neighbourhood of Dalkeith, before a committee of the Dalkeith Farming Society; from whose report it appeared, that the corn was well cut, but was not laid with sufficient regularity. In the succeeding year, 1813, the machine was still further improved, when it was wrought by two horses and one man.

“It was again exhibited before a committee of the Dalkeith Farming Society, who reported that the corn was better laid, but was imperfectly cut. In the harvest of 1814, some additions were made to the apparatus, for the purpose of regulating the application of the cutter, when it is employed on unequal ground: this addition consists in wheels or rollers placed under the cutter, by which it is prevented from sinking into the earth, on a rough surface. But the most successful trials with Mr. Smith’s machine were made in the harvest of 1815, some of which were in the presence of a committee of the Highland Society of Scotland, who gave a most favorable report of its operation; and as an acknowledgment of their opinion of Mr. Smith’s ingenuity, a piece of plate, of fifty guineas value, was presented to him by that respectable body. In the trials alluded to, a Scotch acre of beans was cut down in an hour and a quarter.

“Satisfactory trials were also made in reaping wheat and oats, the latter of which was laid with the most perfect regularity, at right angles to the path of the machine. The operation of this machine in cutting corn is attended with the great advantage, that the grain is not in the least degree shaken; so that the loss which is frequently sustained by the common mode of reaping with the sickle is entirely avoided.”

The account of Kerr’s machine, which appeared in Volume I. of the *Encyclopædia Edinensis*, (with the accompanying Plate IX.,) is as follows:—

“This machine, of which a perspective view is given at Fig. 2, Plate IV., consists of two principal parts: 1st the carriage, and 2nd the drum with its appendages. The carriage is mounted on three wheels, and is partly of wood and partly of iron. The two front wheels are made very heavy, in order to give power to the cutter. The rim is about six inches broad. These wheels move upon a strong axle, which has a catch to carry round the axle with the wheels when the machine is pushed forward, but so fixed as to leave the axle free when the machine is drawn backwards. Upon this axle the two bevil wheels are fixed, only one of which is shown in the figure at D. They are so placed that either of them may be brought into action, and thus the motion may be reversed at pleasure. The ends of the main axle move in couples, connected with a strong bar or bars, passing below the cutter to the frame of the machine. A broad upright beam or frame-work, E, is attached to the bar immediately behind the cutter, on the top of which the long beam F, F, rests, and the whole is bound together with straps and bolts of iron, so as to form a strong and durable carriage. The third small wheel is placed near the bottom of the upright frame-work, E; and the machine thus resting on the three points, sufficiently distant, is not easily overturned. The horses are yoked to the end of the long beam by swingle-trees at F. The horse was yoked by a swingle-tree at the first trial of the machine in harvest 1811; and this method is found to produce by far the most steady motion. The two guards G, G, prevent the horses coming forward on the cutter, in the event of any of the harness giving way.

“The drum A, forms the other part of the machine; and it consists of a frame with iron arms, which are bounded by a circular rim. The arms are covered on the outside with thin wood or basket-work, which commences immediately above the cutter B, and is continued as high as the heads or ears of the growing corn. The cutter or perpetual scythe B, is fixed to the bottom of the rim. It is sharp on the outside or outer edge, and is divided into a convenient number of segments, all of the same size, so that a corresponding part may be easily put on in case of any of the segments being damaged. The drum is carried round upon an upright shaft or axis D, passing through its middle. There is a pinion fixed upon this axis, which pitches in one of the toothed vertical wheels on the main axle, so that when the car-

riage moves the drum is immediately put in motion. The lower end of the pinion shaft or axis rests on a part of the frame directly over the middle of the main axle ; and the upper end of it is kept in its place by the long beam above, which is produced to ϵ , for that purpose. By this arrangement, the whole forms a strong, compact, and simple machine, of which the new invention of the drum, with the circular cutter attached, makes the most important and distinguishing feature. Many machines have been constructed for reaping corn, by some of which the cutting process has been accomplished ; but none of these machines can cut and at the same time lay down the corn regularly, so as to be afterwards operated upon by the threshing machines now in general use. Both these are done in the most perfect manner by this machine. The stalks of corn after being cut are laid down with their heads away from the machine, so as to form a right angle with the line of operation, or path of the horses ; and by this means they may be easily gathered into sheaves.

“ Mr. Kerr’s new invention of the drum and the circular cutter attached, was not made very public till the month of February, 1811, at which time he exhibited his model in its present complete and simple form. Soon after this we find it was laid before one of the first Agricultural Societies in Scotland ; and they entered the date of the exhibition upon their minutes, in order to secure to him the merit of the invention. This appears by the following excerpt from the minute-book of the Dalkeith Farming Society, dated 11th April, 1811 : ‘ One of the members having mentioned that he had seen a very ingenious model of a reaping machine, which the inventor, Mr. Kerr, mathematical instrument maker in Edinburgh, was desirous to exhibit to the Society, for the purpose of securing to himself the priority of invention, in the event of an effective machine being afterwards constructed on the same principle ; the meeting agreed that the secretary should inform Mr. Kerr that they would examine his model at next meeting.’ The model was accordingly presented in the month of May following before a very full assembly, being the anniversary meeting of the Society, and the committee delivered their report, which is also inserted in their minute-book.

“ In the harvest of the same year (1811) Mr. Kerr constructed a large operative machine, and proved the efficiency of the principle of

his invention on a field of corn near Edinburgh. The price of this machine it is supposed will not exceed £20 sterling. Mr. Kerr obtained a premium of 20 guineas from the Highland Society for his model, which was examined by a committee of the directors; and he is to receive a further sum of 20 guineas when he constructs an improved machine on a large scale."

During 1811 a third reaping machine was produced, and formed the subject of Letters Patent (No. 3464), which were granted to Donald Cumming, of Whitefield, Northumberland, on the twenty-sixth of July.

The next person who appeared as an inventor of reaping machinery was Mr. James Dobbs, of Birmingham, by whom Letters Patent (No. 3838) were obtained on the twenty-third of September, 1814.

Mr. Dobbs was a dramatist, and the following notices of his machine appeared in the newspaper at that time:—

(From *Aris' Birmingham Gazette*, Oct. 3, 1814.)

"Mr. Dobbs (late of our Theatre) has just obtained his Majesty's Letters Patent, for a machine for reaping corn. We are informed by a gentleman who has seen it work, that it is a most valuable invention, and is equally adapted for Indian corn, rice, and cutting of sugar canes."

(From *Aris' Birmingham Gazette*, Oct. 10, 1814.)

"For the benefit of Mrs. Dobbs.

"J. Dobbs most respectfully informs his Friends and the Public, that having invented a Machine to expedite the Reaping of Corn, &c., but having been unable to obtain the Patent till too late to give it a general inspection in the field with safety, he is induced to take advantage of his Theatrical Profession, and make it known to his Friends, who have been anxious to see it, through that medium.

"Part of the Stage will be planted with Wheat, &c., that the Machine has cut and gathered where it grew, and the Machine worked exactly as in the Field.

"Any invention that will enable the Farmer to gather his Grain quicker and cleaner than the old method, (in our climate so uncertain,) must be a national advantage of no small consideration; that

the Machine in question possesses that advantage will, perhaps, be better decided by its own merits, than anything its Inventor could say in its favour.

On Friday next, October 14, will be presented the celebrated comedy of *A Bold Stroke for a Husband*.

End of the play, Mr. Dobbs will exhibit Two Machines of different powers and purposes, and explain the principles on which they are made and act; he will also show to what several uses they are designed, with reference to America and the Indies; concluding with an occasional address to his Fellow-Townsmen, being the last time he shall have the honour of appearing before them in a public character.

To conclude with the celebrated farce of *Fortune's Frolic*.

The part of Robin Roughhead by Mr. Dobbs, in which he will work the Machine in character, in an Artificial Field of Wheat, planted as near as possible in the manner it grows.

Tickets to be had of Mrs. Dobbs, No. 4, Bishopsgate Terrace, near the Five Ways; at Aris's Gazette Office, High street; and at the Theatre, where places in the Boxes may be taken.

(From *Aris' Birmingham Gazette*, Oct. 17, 1814.)

"Mr. Dobbs's newly invented Patent Reaping Machine was shown at our Theatre on Friday evening, and appeared to be highly approved of. Mr. D.'s first experiment was completely successful, and we have no doubt the other would have been equally so, had not the scenery obstructed the progress of the machine, which, causing a little embarrassment, prevented Mr. Dobbs from working it so effectually as he could have wished. Mr. D.'s explanation of the principles and properties of this invention was very satisfactory, and we are inclined to think, it will prove of great public utility."

Mr. Scott, of Ormiston, in 1815, produced a reaper, the following description whereof (with the drawings in Plates X., XA.,) is extracted from vol. xvii. of the *Edinburgh Encyclopædia*, page 325:—

"Plate CCCCLXXVIII., Fig. 1, represents the under frame part of the reaping machine; this part supports Fig. 2, on four strong iron pillars; two of them are similar to Fig. A., the other two to Fig. B; into the last mentioned two, a strong iron axis, *x*, is immoveably fixed, on which turn the two roller wheels *c* and *d*, that carry the

machine, as shown by Figs. 1, 3, and 4. Fig. 5, represents the cutter ring, on which are screwed sixteen cutters, all toothed similar to that of a common reaping hook: these cutters are made to cut the corn against the front prongs at the angle of 45°. The form of the prongs to effect this is shown in Fig. 1, of which they form a part, as also in Figs. 3, and 5. The upper frame part of the cutter rings is represented by Fig. 6, and is fixed to it by four strong iron pillars, similar to Fig. E. Fig. 4, is a section of the whole machine, where *a, b, c, c*, represent the under frame part, as shown by Fig. 1, *e, f*, the frame ring as shown by Fig. 2. *e, b*, and *f, c*, the two pillars, as represented by Fig. B, which connect this ring with the under frame part; and into these two pillars is fixed the strong iron axis *x*. *c*, and *D*, are the two roller wheels on which the machine moves. *z, z*, is the cutter ring, as shown by Fig. 5; *z, y*, and *z, y*, are two of the pillars, similar to Fig. E., which connect the upper frame part of *y, y*, Fig. 6, to the cutter ring. Fig. 5 *d, d, d, d*, is a drum, made of thin rolled plate iron, supported by six arms, two of them *r*, and *s*, only appear in the section; each of these arms have T-ends for the better fixing of the drum, and it is strengthened by hoops of iron at both ends: this drum carries twenty-four collectors, similar to Fig. 7, that play in eyed studs, see Fig. 12. On the inside of the roller wheel *c*, is fixed a ring bevil wheel, *u, u*, of forty-eight teeth, which turns the bevil wheel 1, of twenty-four teeth. On the same axis with the wheel 1, are two wheels fixed on a hollow axis, but which play freely on the axis of the wheel 1; the uppermost of these two wheels, marked 2, has twenty-five teeth, that act in the teeth of the wheel 3, of twenty teeth; the small wheel 4, of ten teeth, turns the wheel 5, of thirty teeth: on the top of the axis of the wheel 5, are fixed the arms that carry the drum. On the top of the hollow axis of the wheel 3, is fixed a flange, that is firmly bolted to the upper part of the frame of the cutter ring. The under-end of the axis of the wheels 1, 2, and 4, plays in a brass socket in the great axis, and the upper end in a bushed hole *o*, in one of the arms of Fig. 2, and *e, f*, Fig. 4.

“The hollow axis of the wheel 3, of twenty teeth plays in a deep brass bush fixed into the centre of the upper frame ring, Fig. 2, and *e, f*, Fig. 4, and the under end of the axis of the wheels 3, and 5, plays in a bushed socket in the great axis, and can be adjusted by the

screw 9, Fig. 4. There are two stubs on the under side of the wheel 1, and other two on the upper side of the wheel 2; the stubs of the wheels 1, and 2, can be brought into contact or disengaged at pleasure, by means of the lever *L*, Fig. 3, that pushes in or draws out a kind of slit wedge on an inclined part in the great axis, immediately below the wheel 4, having its inclination contrary to that of the wedge: when the lever *L* is put into the notch *m*, the roller wheel *c*, will put the machinery in motion; and when it is put into the notch *n*, the machine may be moved forward, and the machinery remain at rest.

“ In the section, Fig. 4, one of the front prongs is shown, which could not otherwise be represented with regard to the position of the roller wheels: on each of the front prongs is fixed a piece of hard wood, to which are screwed two thin iron prongs *k*, placed at the best angle for pressing the root end of the cut corn into the collectors, as also out of the way of the corn to be cut.

“ Fig. 3, is a plan of the machine, where *c*, and *d*, represent the roller wheels; *u, u*, the ring bevil wheel that is fixed to the inside of the roller *c*; the circles 1, 2, 4, 3, and 5, represent the wheel-work as shown in the section, Fig. 4; *e, f*, the upper ring that is supported by the under frame part; *y, y*, the ring that carries the cutter circle; *t, u, v, w*, a deep ring of hoop iron that serves to work the collector-hooks out and in through holes cut for each collecting hook in the thin plate iron drum *d, d, d, d*. Each collector axis has two tails, one of them hinged and the other fixed; the hinged or jointed tail is represented at *x*, Fig. 7, and the mortice for the fixed tail at *z*. The ring *t, u, v, w*, has two long slits, the one from *v*, by *u*, to *t*, which the tails *x, x, x*, &c., pass through when on that part of the ring; the other slit is cut from *v*, by *w*, to *t*, which the tails *z, z, z*, &c., pass through when moving round that part of the ring. At that part of the circular hoop where the tails *x, x, x*, &c., pass through a groove commences, formed on the outside of the hoop by means of two rods of iron, rivetted at a little distance from each other on the outside of it, for the tails *z, z, z*, &c., to travel along, while the tails *x, x, x*, &c., are through their slit; and where the tails *z, z, z*, &c., pass through the hoop, a similar groove commences on the outside of the hoop for the tails *x, x, x*, &c., to travel in, while those of *z, z, z*, &c., are travelling through their slit. When the tails *x, x, x*, &c., pass through

their slit in the hoop, the tails *z, z, z, &c.*, travel in their groove, by which the hooks of the collectors are thrown out, so as to collect the cut corn; and when the tails *x, x, x, &c.*, travel in their groove, the hooks of the collectors are thrown in, and the cut corn allowed to fall to the left hand in a continued swath. The curved piece *v*, guides the tails *z, z, z, &c.*, into their groove, and in like manner the curved piece *t*, conducts the tails *x, x, x, &c.*, into their groove. Two semi-circles were cut out of strong rolled plate-iron, one with prongs exactly cut to correspond with the front prongs of Fig. 1. These semi-circles were made truly flat by hammering, and then joined so that the circular parts formed one circle; it was then placed upon the bottom frame, with its prongs corresponding to those of the frame; the prongs of the plate-iron, and those of the frame were then rivetted together with rivets, as appears by the dots on the prongs, Fig. 3: by this means the fore part of the plate-iron circle was kept at a proper height, for the cutters on the cutter circle to pass through between the bottom frame prongs and those of the plate-iron. The hind part of this circle was supported by several kneed pieces similar to Fig. 8,—the short legs being rivetted against the underside of the bottom frame, and the long legs made to support the plate-iron circle, leaving space sufficient for the cutters to pass. This plate-iron circle was made of a breadth to reach into the circle, *t, u, v, w*, Fig. 3, that work the collectors; and this ring is supported by kneed pieces, rivetted to it and the circular plate, similar to Fig. 9; and they are so formed as to give strength to the parts of the hoop *t, u, v, w*, where the slits are, and at the same time permit the tails of the collectors to pass through. The dotted circle, Fig. 5, shows the inside of the rolled plate-iron circle, but is only there represented as covering the front prongs. There was fixed on the long right hand prong, *p*, Fig. 3, a sheet of thin plate-iron, kneed to the same acute angle with the prong, and of the same height with the drum, for the purpose of dividing the standing corn from that to be cut. And there was also an inclined piece of sheet-iron, &c., so placed on the left hand side of the machine as to prevent its progressive motion from carrying the root end of the corn too far forward after being cut. *g, h*, Fig. 3, and Fig. 10, form the draught-bar by which the horse draws the machine, with traces on the stubble side

of the field. Fig. 11, represents another kind of a cutter circle, which probably might have been found, on trial, preferable to the one that was introduced into the machine; the cutting part of it was to have been made in segments of iron faced with steel, of a shape that would have admitted the whole height of their faces being struck or cut with teeth at a proper angle, similar to those of a coarse-struck reaping hook: the form of these segments is represented in the Fig. at *x, x, x*, &c. There were small tongues *t, t, t*, &c., to be formed on the cast-iron part of the cutter circle, of the same height with the thickness of the cutter segments, and which, with the screws shown in the figure, would have effectually prevented the segments being forced out of their places; the front prongs shown in this figure are to be supposed as those of the under frame, and which are there placed to show the form that they ought to have been made of, so that this circular cutter might have cut to the best possible advantage against each prong. The bottom prongs are there represented as covered with those of the rolled iron plate circle, as described by the other figures, and which in Fig. 11, is to be supposed to extend to the dotted circle, *a, b, c, d*, as in Figs. 3, and 5. All the figures are drawn to a scale of twenty inches to the inch, except Fig. 12, which is drawn on a larger scale on purpose, the better to show how the collectors, Fig. 3, are wrought. In Fig. 12, *t, y, s, t*, represent part of the drum, and *a, b, c, d, e*, part of the hoop that works the tails of the collectors. *s*, and *s*, represent two of the eyed studs that are fixed into the upper and under hoops that strengthen the drum, for the pivots of the axis of the collectors to play in; *t*, and *t*, two of the longer studs, fixed in the under hoop of the drum, for the hinged tails, *x*, and *z*, to play in. The tail *z*, is represented as moving in its groove, and the tail *v*, travelling in its slit, and which is just about being directed into its groove by the curved piece *d*; when at the same time the tail *z*, will enter its slit, and the hook of the collector, *m*, will be thrown into a position similar to that of *n*. And again, the tail *u*, is represented as moving in its groove, and the tail *x*, in its slit, and which is about being guided into its groove by the curved piece *b*; when at the same time the tail *u*, will enter its slit, and the hook of the collector *n*, will be thrown into the position of *m*, in the figure.

“ *y*, Fig. 12, represents one of several thin brushes, fixed into the

under rim of the drum, made of two pieces of iron rivetted together, with a range of bristles between, for sweeping forward the root end of the cut corn, and keeping that part of the cover plate clean swept.

“ The reaping machine here described differs much from all those attempts that the writer of this article had any knowledge of; not only in the construction of its different parts, but also in the nature and form of its cutters and front prongs, as likewise in the method of working the machine itself. With regard to the cutters, a variety of experiments were made with cutters of different forms, as also in the manner of applying them; when it was ascertained that the draw cut of the common reaping hook was inferior to none for cutting corn, besides having the property of seldom requiring sharpening, as is manifest from the common reaping hook that will cut for a whole harvest without requiring sharpening. But to give toothed cutters that are fixed upon a revolving circle the best form to act similar to a draw cut, it is necessary that they form an angle of forty-five degrees with the diameter of the revolving circle on which they are fixed; but from the variety of positions that cutters moving circularly present themselves to the corn during every revolution, no two of them can cut the corn to the same advantage, if the straight prongs that have been adopted by others were to be used; it was therefore found absolutely necessary to form that part of the front prongs against which the cutters cut the corn in lines that formed with the cutters the angle of forty-five degrees, as represented in the figures.

“ With regard to working the machine, the difficulty of working a reaping machine arises from the corn that is to be cut standing in the way of the best possible line of draught, and the necessity of yoking the horse in such a manner that he shall neither tread upon the cut nor uncut corn. Trials were made on different methods, but the one that was found to be by far the most suitable, was nearly upon the principle that boats on canals are drawn by horses; the boat is kept in the middle of the canal by means of the helm; the horse is yoked to the boat by means of long traces, and walks at the distance of between three and four feet from the brink of the canal. To apply similar principles to a reaping machine, handles of sufficient length were

placed behind the machine to give a man power to keep the roller wheels, upon which the machine moves, at right angles to the line of the corn to be cut, so as to produce an effect similar to that of the helm upon the boat. The horse was yoked with traces to the fore corner of the machine next to the stubble, as shown by Fig. 3, where he was at liberty to travel without treading either upon the cut or uncut corn, and exactly in a line parallel to the direct course of that point of the machine to which he was yoked, and not, as in the case of the canal boat, at several feet distance from the parallel of that line; which shows that a horse can be yoked in a more advantageous line of draught to a reaping machine than to that of a canal boat; besides the left hand roller wheel on the side that the horse draws the machine, works all the machinery part, and therefore makes it no way difficult for the man at the handles to keep forward the right hand roller wheel, it being at liberty to turn freely upon its axis.

“As to the smith-work of the machine, a great error was committed in making the under frame part, that supported the whole machinery, of too slender a bar of malleable iron, and which had to be formed into a circular ring the flat way; for by the great number of heats it received in the blacksmith's fire before he could bring it nearly to a circular form, he reduced it much in strength; and it was further reduced by filing and grinding before the blacksmith could make it into a truly flat and circular ring; and of necessity it had, after all, to be pierced with a number of holes for the pillars, &c., &c.; so that, when loaded with the weight of the machine, it vibrated much, even when travelling along a smooth even surface. A similar error was also committed in making the cutter circle of too thin malleable iron; for which reason the figures of these parts are here drawn to represent cast iron circles, as all the other circles of the machine were. With respect to the other parts of the machine they acted up to expectation.

“The only uncut corn that was in the immediate neighbourhood of the machine, was that of a small corner of coarse new broken up lea ground, sown for the first time with oats, of about thirty yards in length.

“The first trial of the machine was made in presence of several spectators, on the side of the plot that appeared to have the evenest

surface; when the machine cut and collected in a very neat manner the length of the plot, not leaving behind it a single uncollected straw, and laid down the cut corn into a regular continued swath, nearly at right angles to the line that the horse travelled in. By the machine cutting in this manner thirty yards in length, was evidently shown the practicability of making a machine to cut a much greater extent, as also free from all the defects here mentioned. The next trial of the machine was discouraging to those who could make no allowance for the slenderness of the bottom frame, which ought to have been thrice the strength that it was made of.

“The piece of ground that the second trial was made on was much more uneven than we were aware of; for the unrotten rushy sward was found to be nearly as the plough had left it, the horse having only moved forward for a short way when the roller wheels sunk into a deep unobserved hollow; and the exertions of the horse made the bottom part of the frame bend so much up, as caused the cutters to act against the cover plate with such force, that one of the cutters cut an inch and a quarter into it, another at the same time three fourths of an inch, and a third nearly half an inch; which was a sufficient proof of the power of the machine, but at the same time more than a sufficient proof of the weakness of the bottom frame part. Several private trials were afterwards made with the machine; but it is unnecessary to give any other report of them, than that the great defect in the strength of the bottom frame part was manifest in them all.”

The above description of Mr. Scott's machine is succeeded by the following account (illustrated by Plate XI.,) of the improvements made by Mr. Gladstone in the reaper invented by him in 1806:—

“In our article on Agriculture we have given a full description, accompanied by a drawing, of the first reaping machine invented and constructed by Mr. Gladstone, an ingenious millwright at Castle Douglas. In putting that machine, however, to actual trial, Mr. Gladstone found, that as the teeth for gathering the corn were on the upper side of the cutter, they never could get quit of the cut corn. The machine cut a yard's length with great perfection; but the corn after this stuck in the teeth, so that the growing corn was shoved forward, and the cutter went over the top of it. He was, therefore, led to remedy this evil by the construction which we shall proceed

to describe. This reaping machine is wrought by one horse, and is represented in Plate CCCCLXXIX. Fig. 13, is a view of the side of the machine farthest from the growing corn. A, represents the shafts for the horse, like those of a common cart. B, a diagonal piece of wood, as shown at B, in Fig. 19, for the purpose of strengthening the frame. C, is the wheel, carrying the one side of the machine, and giving motion to the gatherer by means of a pinion, working into a wheel fixed on the gatherer at H, on Fig. 19, at M, in Fig. 18. K, is a block of wood or bolster for supporting the axle of the wheel C, and L, L, L, L, is the gatherer, moving round the common centre N, and having the form of a cylinder of thin boards, with teeth starting out from holes at the side where the corn is cut, and put back again within the cylinder, as at Fig. 15. P, is a small wheel, carrying the principal part of the machine, with segments of cast-iron on it, acting on the pinion on the socket of the cutter, as at Fig. 14. Q, represents teeth of wood, for gathering up the straggled corn, and holding it or preparing it for the cutter, as at Fig. 19. Fig. 14, is a view of the cutter by itself, having a socket of cast-iron, with a pinion upon the socket about two inches in diameter, to take into the upright bar, Fig. 17, which is the centre-bar, and is acted upon by the wheel P, whose motion is obtained from the surface of the ground and the weight of the machine.

“The cutter has four iron arms, screwed into the last socket at the top, and bent, as at R, R, on purpose to allow the teeth of the gatherer to pass, when thrown in by the circular pin of wood, as at Fig. 19; and the cutters are in six pieces, and bolted to a bar of iron at S, S, to which the arms are bolted likewise. Fig. 15, is a view of the gatherer by itself, only the circular bars to put out and in the teeth of the gatherer, as the gatherer comes round. As the teeth and cross on the top are all fixed on one piece, when the gatherer comes round the end of the cross at T, will strike the circular bar V, and by that means send out the teeth to catch the corn at W; and the other pieces of circular wood, at X, will send in the teeth to the straight of the cylinder, and thus drop the corn without scattering any of it. This gatherer is made of two slender wooden rings, and is covered on the outside with thin boards, with a socket of cast or malleable iron, to turn on the bar V. The cutter and gatherer are both fixed

on the same bar. Fig. 16, is a view of the teeth of the gatherer by itself. Fig. 17, is a view of the centre bar, the top part of which is square, fitted into the frame,—a plate of iron being on the under and another on the upper side; the middle being round turned and smooth for the cutter; and the gatherer acting upon the bottom part, square like the top, only the square is taken from the round, so that the sockets may go on. On the bottom square is fitted a piece of iron, either cast or malleable. The cast iron is no doubt cheaper, but malleable iron is better. Its use is to fix the teeth for gathering the corn, and likewise for the centre of the centre wheel, for carrying the machine, as at *p*, in both Fig. 18, and 19. Fig. 18, is a view of the machine behind, showing how the cutter and gatherer pass one another, and how the teeth are fixed that gather up the loose corn. Fig. 19, is a view from the top of the machine, showing the framing and top of the gatherer, part of the cutter, and gathering teeth.

“When the machine was thus constructed it was subjected to trial, and it was found to have no tendency to choke, but kept itself clear, and laid down the corn with great regularity. The teeth in the gathering cylinder were placed rather high, so that the corn leant a good deal from them, so as to bring the lower end of it round first, and lay it at an angle of about forty-five degrees, whereas it would have been better if it had been laid right across. This could easily have been accomplished, by drawing the machine right against the corn. The sharpening apparatus is not given in this machine, because it has already been introduced into the machine described under our article ‘Agriculture.’

“Mr. Gladstone has likewise constructed a machine for reaping beans, which has been actually used, and which cut down, in great perfection, four acres in a day, with one man and one horse. The beans were afterwards to be gathered into sheaves and bound up; but we believe Mr. Gladstone afterwards made similar machines, in which the man guided the machine, and either gathered the beans, or made the machine gather them at the same time.”*

After Mr. Scott's machine came that of Joseph Mann, of Raby,

* See the description of Gladstone's bean reaper at p. 46 of this Appendix.

Cumberland, who invented a machine for reaping, in 1820, but did not bring it before the public until 1832. A description of this machine is given (with the accompanying Plate XI.,) in vol. iv. of the "Quarterly Journal of Agriculture," at p. 250, as follows:—

"On a New Reaping Machine, invented by Mr. Joseph Mann, of Raby, near Wigton, Cumberland. With a Plate. By Mr. James Slight, Curator of the Museum of Models of the Highland Society of Scotland.

* * * "During the last thirty years, many attempts have been made, and high premiums have been offered, for the production of a perfect reaping machine; and some of those brought forward have possessed very considerable merit.

"Among the early machines of this class, Mr. Smith's, of Deanston, stands in the first rank; and that of Mr. Gladstone, of Castle Douglas, also claims attention. Besides these, as is well known, a number of others have appeared, possessing various degrees of merit. Out of the whole has lately sprung that of Mr. Bell, which has been noticed in a late number of this Journal. In all these attempts, but especially in those that have been in any degree successful, there seems to have occurred, with slight exceptions, but two modes of applying the cutter to the corn: these are, the revolving-cutter acting like a circular saw, and the lever-cutter acting like shears; both of which have their peculiar merits, and both seem to be efficient in as far as the single act of cutting is concerned; but it is in the more complicated process of gathering the corn and depositing it in regular order after it is cut, that these machines have in some degree failed. It therefore follows that, to this point, in the process of reaping by machinery the attention of the machinist should now be directed, and in this field there seems to be ample room for the exercise of the ingenuity of man.

"The object of this communication being to place before the public a new competitor in the harvest-field, Mr. Mann, of Raby, near Wigton, Cumberland, I shall, in the first place, before describing it particularly, notice the trial that was made of his machine at Kelso. This gentleman, under the auspices of the Highland Society of Scotland, brought forward a new reaping machine, which was exhibited in the department of implements at the general show of

stock, held at Kelso, in October, 1832. The Society previously guaranteed to him a sum of 10*l.* to defray the expences of transporting the machine to Kelso, leaving to its own merits the chance of obtaining such a premium as the judges of the show might award.

“In consequence of the early harvest of last year, the crops had been almost entirely cut down in that neighbourhood before the day of the show.

“The only piece of standing corn to be found was at the distance of four miles from Kelso, and thither the machine was transported, in order to be seen in actual operation by a committee of the judges.

“It happened that the field of operation was a small patch of unripened oats, much straggled, and which had been considered so worthless that cattle had been allowed to traverse it.

“It may therefore be conceived that the trial was disadvantageous to the machine; but, under all the circumstances, it performed in a tolerably satisfactory manner.

“The corn was fairly cut, and it was considered by those who had seen other reaping machines at work, to lay the swathe more regularly at right angles with the line of direction than had been observed of previous machines.

“In going up hill (for the ridges lay at a high inclination) it was observed not to perform so well as down hill; and, owing to some imperfection in the construction of the frame-work, it appeared also to work imperfectly across the ridges. Upon the whole, the trial of the machine, although it called forth much general approbation, was not of such a satisfactory nature as to merit the award of a premium, further than an offer from the Society of an additional sum of 10*l.* to Mr. Mann, when he produced a model of the machine, with such improvements as might occur to him.

“Before giving a detailed description, it may not be uninteresting to trace the steps by which Mr. Mann has brought his reaping machine to its present form. To those who may be treading in the same path, Mr. Mann’s opinions may, perchance, be of service, whether as beacons to guard them from foundering on what may be errors, or as guides to direct them to what may be useful: the facts are collected from his own communications.

“In early life, Mr. Mann seems to have directed much of his time to the pursuit of mechanical operations, and in the year 1820 brought out his first model of a reaping machine: this appears to be on the same general principles as the one now before us; it was mounted on three wheels, furnished with six cutting knives, six vertical gathering rakes, and also a second revolving rake for stripping the former of the collected corn, and the draught was applied as in the present instance, at one of the angles of the frame.

“This model was exhibited to the Abbey Holme Agricultural Society, who expressed their approbation of it, and advised a two-horse power machine to be made, with some proposed alterations, one of which was, that the horses should propel instead of draw the machine. Of this last proposition Mr. Mann seems to have entertained no favourable opinion.

“In 1821 the new machine was exhibited, in model, before a numerous meeting of gentlemen; and in the harvest of the following year, a full-sized one was brought forward in a working state; but it was found that, in fulfilling the numerous conditions laid down, the machine had become so complicated, that its utility was now doubtful. Accordingly we find that, after a very short trial, it was laid aside.

“Nothing further seems to have been done till 1826, when the machinist seems to have returned to his favourite point of drawing instead of propelling the machine; for in that year he again brought it forward nearly in its present form, and it was again attended with only partial success.

“From that period Mr. Mann seems to have been occasionally adding such improvements as from time to time occurred to him; and now, in summing up, he avers that his machine contains the four principal points of a good reaping machine: 1st, it preserves the parallelism of the line of draught, though drawn from an angle; 2nd, the polygonal cutter; 3rd, the gathering process, performed by revolving rakes; and lastly, the process of stripping the rakes in such a manner as to lay down the cut corn in a regular swathe. The machine, as now executed, cuts a breadth of $3\frac{1}{2}$ feet at each turn, is capable of cutting down 10 acres in a day of ten hours, and is drawn with ease by one horse.

“ Such is a brief outline of the history of Mr. Mann’s reaping machine, which is here offered without any remark; but trusting that, as it seems to possess some degree of merit, it may form a step in the solution of the problem that has so long occupied machinists, and which, it is hoped, will ere long be finally demonstrated, and the reaping machine be deemed as essential to a well-regulated farm, as the thrashing machine has been for many years past.

“ Plate I., Fig. 1, is a geometrical elevation of the machine, and Fig. 2, a horizontal plan. The same letters of reference are used for both figures. The cutting process is performed on the revolving principle, but instead of a circular cutter, one of a polygonal form has been adopted, of twelve equal sides. By the adoption of this form of cutter, the action on the standing corn is somewhat different from that of the circular cutter; with the latter the cutting edge is continually in contact, but with the polygonal cutter the effect is produced by a very rapid succession of strokes, arising from the inclination of the cutting edges of the polygon to each other; for, as can easily be shown, the angles at a, a , in Fig. 3, being farther from the centre of revolution than any point taken in the side, comprehended between the points a, a , any body, as a stalk of corn, opposed to the cutting edge, will be forcibly acted upon when the angle is passing the stalk; but if passing without completely separating it, the cutting edge will then recede from it until the succeeding angle comes into contact. When the cutter has a progressive motion, this effect is altered only in degree; for still the first half of the side from a , to b , will produce little or no cutting effect, while the remaining half will give a species of stroke somewhat resembling that of a scythe, which it is presumed may produce a greater effect than if the edge were continually in contact, especially against a flexible body like the culm of the cereal grasses. The cutter i, i , Fig. 2, is formed of twelve separate segments of thin steel plates, fixed upon the extremities of a corresponding number of arms, attached to a vertical shaft. The joinings are formed by the ends lapping over each other, the joints being situated posteriorly to the angles of the polygon in relation to its motion of revolution. The segments are fixed to the arms by means of slender sliders, which are rivetted to each end of the segments, and, passing through a clasp in the end of the arms, they are secured in pairs by a screw-

nut. Fig. 4, shows one of the segments with its sliders *a, a*. Fig. 5, is a cross section of an arm and clasp, embracing its two contiguous sliders;—*b, b*, being the cutter, as seen edgewise with the sliders; *c*, is the clasp; and *d*, the nut which draws up the clasp upon the sliders.

“By this arrangement, any one or the whole of the segments can be removed and replaced in the course of a few minutes.

“In calculating the motions which are introduced to drive the cutters, it appears that when the machine travels at the rate of $2\frac{1}{2}$ miles an hour, the cutter will make 175 revolutions per minute. The next operation is the gathering, which in this machine has assumed a new form. A skeleton cylinder is made to revolve upon the vertical shaft of the cutter frame; it is mounted with a set of vertical rakes to the number of 25, each armed with 9 wooden teeth and one of iron, for greater strength set next the cutter. This cylinder with its rakes revolves concentric and in the same direction with the cutter, but at a greatly reduced velocity, making only 28 revolutions per minute, or nearly one to seven of the cutter. Its office is to collect the stalks of corn as they are cut, and carry them round to the near side. In order to discharge the contents of the rakes an ingenious and simple contrivance is adopted, in the form of a comb attached to the near side of the machine.

“The comb consists of eight teeth, marked with the letters *h, h*. These teeth, standing in the spaces between those of the rakes, strip the latter of their collection of cut corn, as they successively arrive at the point of contact with the comb. The corn by this action is deposited in a continuous swathe, nearly at right angles to the line of direction. To prevent any of the corn getting within the teeth of the comb, a line of thin iron wire is twisted round each horizontal row of teeth, forming a number of bands, standing about two inches from the roots of the teeth, too minute to be shown in the figure. As the points of the teeth of the comb stand always within the circles formed by the wires, they catch every straw that is taken hold of by the rakes. The frame-work of the machine is of a trapezoidal form, having the rectangles in the hind part, and the acute angle in front to which the draught is applied.

“The third part is supported upon two carriage wheels, *A, B*, and the fore parts are chiefly supported upon the castor wheel in front, which

is attached to the moveable stem *c*, made to turn in the iron collars *d*, *d*. The arm *e*, to which the horse shafts are applied, is firmly attached to the stem, so that, in the act of turning, the castor wheel follows the direction of the horse shafts, and causes the machine to turn round in a very small space.

“ Besides these three principal wheels there is a fourth, in the form of a small roller, working in the extremity of the perch *r*, which is intended only as an incidental support to the cutter and rakes, the common shaft of these having its footstep in the extremity of the perch.

“ As already stated, the horse shafts are applied to an angle of the frame-work, which becomes necessary that the horse may go before the machine, walking by the side of the standing corn. Although the draught is thus applied to an angle, the effect which might be anticipated of throwing the machine out of the parallel line, and causing it to move in the direction of its diagonal, does not follow; for, in practice, it is found that the machine has no tendency to deviate from a line of direction parallel to itself. This, it is presumed, is effected partly by the off-side wheel being in advance of the other, and partly by the tendency to deviation being counteracted by the resistance of the standing corn against the cutter. The motion of the active parts is communicated by the off-side carriage wheel, on the axle of which is mounted a bevelled wheel *a*, of 46 teeth, and on the upright shaft *b*, is mounted a pinion *c*, of 20 teeth, working in the former. The same upright shaft carries two pitch wheels, the one, *d*, *d*, of 8 teeth, which drives the rakes, and the other, *e*, *e*, of 28 teeth in Fig. 1, shown only in dotted lines, for driving the cutter. On the top of the cutter shaft is fixed the pitch wheel *f*, *f*, of 9 teeth, also shown in dotted lines; and to the rake cylinder is attached the pitch wheel *g*, *g*, of 21 teeth. These two pairs of pitch wheels, being respectively connected by their chains, give motion to the two principal actions of the machine. The subsidiary motions are effected in the following manner:—The projecting iron bar *g*, is fixed to the pendant bar, *h*, of the frame-work; the lever *i*, *i*, is supported in its fulcrum, which turns on the head of the stem; and a connection is formed by the chain *k*, between the end of the lever and the fore part of the machine by means of the bar *g*. By this combination, together with

the chain *L*, the director of the machine has it in his power to raise or depress the fore part and cutter at pleasure.

“There is the same facility of raising or depressing either side of the cutter to suit the rounding of ridges and for running in deep furrows. For this purpose, the axles of both wheels of the carriage are supported in sliding bars with guide rods *N, N*; and by means of levers, one only of which is shown at *O*, the director has the power at any time of altering the inclination of the cutters with reference to the horizon, in the transverse direction of the machine. The following additional reference is given to parts not already noticed in the description. *P, P*, &c., the parts of the framework; *Q*, the horse shafts; *R*, an iron brace, supporting the lower end of the comb; *S*, the castor wheel, with its shears as attached to the stem; *M*, the pitch chains; *N*, upright shaft of the cutter and rakes; *O, O*, &c., the arms of the cutter and cylinder; *P*, the upper rim of the cylinder; *Q, Q*, &c., the ends of the arms to which the cutters are attached.”

In 1822, Mr. Henry Ogle, of Renington, near Alnwick, invented a machine for reaping corn, to which, in the same year, an apparatus for collecting the corn into sheaves was added by Messrs. Thomas and Joseph Brown, of Alnwick. The machine is explained in the following letter, which, with a drawing of the implement (Plate XIII.), appeared in vol. v. of the *Mechanics' Magazine*, at p. 49.*

SIR,

In the year 1822, I made a small model of a machine for reaping corn; but not being a workman in that business myself, and being on very friendly terms with one Thomas Brown, a founder, in Alnwick, and his son, Joseph Brown, I presented it to them. They made a better model of it than I had made, of iron, and presented it to the public many market days at Alnwick, thinking to carry it into execution by subscription, but were disappointed,—the farmers considered it an impossibility. Thomas and Joseph Brown then made the machine at their own expense, and tried it first near Alnwick; it did not however altogether answer, the teeth of the frame *D, D*, where the knife cut upon, (as hereafter described,) were too long, and

* It is likewise noticed in Loudon's *Encyclopædia of Agriculture*, p. 427.

collected the dirt among the corn too much. They then made the teeth shorter, and tried it again at a place called South Side, near Warkworth, in a field of wheat : it then cut to great perfection, but still, not laying the corn into sheaves, the farmer did not think that it lessened the expense much. Mr. Brown took it home again, and added the part for collecting the corn into a sheaf, &c., when he tried it again at Alnwick, in a field of barley, which it cut and laid out in sheaves extremely well. Messrs. Brown then advertised at the beginning of the year 1823, that they would furnish machines of this sort complete for sheaving corn at the beginning of harvest, but found none of the farmers that would go to the expense, though the machine was seen even to cut the lying corn where it was not bound down with new rising green corn. Some working people at last threatened to kill Mr. Brown if he persevered any farther in it, and it has never been more tried. It was estimated, from what was tried, that it would cut at an easy rate fourteen acres per day. For the encouragement of farmers and mechanics, I here give the following account of this machine : —

DESCRIPTION.

D, D, the frame which the knife acts upon.

E, E, the knife that acts upon D, D.

B, B, B, B, represent the frame on which the machinery is fixed, with the shafts for a horse.

C, C, an axis which turns round in the frame at O, O.

A, A, &c., are the wheels, which are fixed fast upon the axis, turn round with it, and give motion to all the other parts of the machine.

D, D, is a frame of iron or wood, with teeth in it about three inches long.

E, E, is a knife, which acts upon that frame, a little upon the teeth.

X, X, X, an instrument fixed upon a centre upon a frame at M, turns upon it, and acts in the teeth of the wheels A, A, &c. ; leaving the cog of the wheel on the one side, and catching it on the other, keeps the knife sliding and cutting out and in, in a very quick motion.

F, F, F, F, is a rake that goes round by a belt or chain, upon two pulleys or wheels, and lashes the corn backward upon the knife : it is just eight small iron bars or rods, placed in a circle, in a cylindrical form.

c, c, c, c, a platform, made of thin deal or tin, made to go on hinges on the back of the frame that the knife acts upon, and collects the corn as it is cut; this frame is lifted till as much corn is collected as will be a sheaf, and then let fall by a lever *h, h*, over a fulcrum upon the frame *B, B*, &c., where the corn slides off, when it is a little raised again. It was found, however, to answer better when it was put off by a man and a fork towards the horse, as it is easier bound, and leaves the stubble clear for the horse to go upon.

I have only given a part of the framing, as most mechanics take their own way of fixing the main principles.

I am, Sir,

Your most respectful well wisher,

HENRY OGLE,
Schoolmaster.

Renington, near Alnwick,
Northumberland.

In 1823 there was published in the *Mechanics' Magazine*, an account, with an illustration (see Plate XIV.), of a machine for mowing, for which a patent had been obtained in the United States, by Jeremiah Bailey. The description of the apparatus, at page 145, of vol. i. of the *Mechanics' Magazine*, is as follows:—

“The mowing machine, of which the above cut is a representation, was invented by Jeremiah Bailey, of Chester county, United States, who has obtained a patent for the same.

“It has been extensively used and approved of, during the last season, in the neighbourhood of the patentee, and promises to be of great public utility. It is understood that it will mow ten acres per day. The following description will explain its operation, and show the skill and ingenuity of the inventor:—

“This machine is supported by two wheels, on different axles. The left wheel is fixed to its axle, so that they revolve together. The right revolves on its axle like a common cart wheel, and is placed about a foot further back than the other. The left works within the frame, and has a circle of cogs screwed on the outside of the felloes, but of a less diameter, to keep them from the ground. These cogs work into a vertical cog wheel in front, that turns an iron shaft, extending horizontally towards the centre of the machine; upon the

inner end of this shaft is fixed a vertical face wheel, whose cogs turn a trundle-head on a vertical shaft. To the bottom of this shaft, near the ground, is fixed a circular horizontal frame-work, on the circumference of which is screwed the scythes in six parts, laid horizontally, with the edges turned outward, so as to form a complete circle. To keep the scythes at a proper distance from the ground, the bottom of the shaft is supported on a piece of wood of the machine, secured by a tye from the tail, somewhat resembling a sled runner, in which it works in the manner of a gudgeon; with the inequalities of the ground, the scythe frame, shaft, and trundle-head rise and fall.

"The edge of the scythe, in its revolution, passes under a whetstone, fixed on an axis, and revolving with the scythe. To create friction, this axis is more or less inclined to the line of direction of the revolution, according to the friction required. This stone, by means of a sliding rod, by which it is attached to the machine, rises and falls with the scythes.

"To prevent too great a pressure of the trundle shaft and scythe frames on the ground, a lever, like a steel-yard, is fixed to the top of the shaft, extending to the tail of the machine, where it is weighed according to the nature of the ground and grass.

"The horse is put into shafts and walks in front of the left side of the machine, and always on the mowed ground after the first swathe is cut.

"By the increase of velocity the scythes revolve with great swiftness. The grass, as it is cut, is first thrown, by the progressive motion, against a rise in the scythe frame toward the centre, and by the same motion is afterwards thrown off in a regular row, following the centre of the machine."

The Rev. Patrick Bell, of Carmyllie, Forfarshire, in 1826, invented an apparatus for reaping corn, which has been in use from that period to the present time. The annexed account (with the Drawings, Plates XV., XVI.,) is taken from Loudon's *Encyclopædia of Agriculture*, p. 422.*

"Bell's reaping machine (figs. 376 and 377,) is the most recent as well as the most perfect invention of this description. The frame-

* This machine is also described in the *Quarterly Journal of Agriculture*, vol. i. p. 217.

work of this machine, A, A, may be made lighter or stronger according to circumstances. B, B, and C, C, are four wheels, upon which it is mounted, of whatever form it is made; B, B, have their spokes at right angles to their naves, and are $3\frac{1}{2}$ feet diameter. For neatness' sake, the naves are made of cast iron; the wheels are from five to six inches broad at the rims, and are surrounded with a slight hoop of iron. Were they made narrower in the rims, when the ground was soft they would both cut it and drag, without giving motion to the connected parts of the machinery. The small wheels C, C, which support the front of the frame, are (like the large ones, B, B,) made of wood: they are fourteen inches in diameter, and six inches broad at the rims, with a very slight hoop of iron round them. Their axles, which are of iron, are screwed to the frame, and are about $1\frac{1}{4}$ inches in diameter. The wheels are placed as near the front of the frame as possible, the reason for which will appear when the general description of the machine is given. The wheels B, B, are connected with the main axle D, in such a manner as that they may turn upon it, similarly to a carriage wheel, without moving the axle with them; or they can be fixed to it at pleasure, so as to turn it round with them as occasion requires. For this purpose, the holes in the naves are circular; and of course so much of the axle as passes through them is round. There are cross flanges, cast upon the nave, which catch hold of the coupling-box E, when the machinery is to be moved, and are disengaged from it by the handle F, when the machine is going, without moving the machinery. In the engraving, this part of the apparatus is entirely concealed at one of the wheels, except a small portion of the handle at H. The other coupling-box is but faintly represented at E. The handle F, has a joint in it, which is fixed to the other half of it, which passes through the frame of the machine, and terminates with the handle H, so that both coupling-boxes can be managed by the driver, standing at H, although they are on opposite sides of the frame. The main axle, D, is $3\frac{1}{2}$ feet long between the shoulders, and eight inches from the shoulders to the coupling-box: the frame of the machine is four feet broad, by seven feet long. Fixed upon the main axle, D, is the bevilled wheel I, of sixty teeth, part of which is seen in the engraving. This bevilled wheel moves two pinions of ten teeth each. These pinions

are concealed in the plate by the frame of the machine : one of them turns the crank-rod κ , and the other gives motion to the coupling wheels L, L , upon the top of the frame. The crank-rod κ , being thus put in motion as the machine moves forward, the crank M , which gives motion to the cutters, revolves with a uniform and steady motion. N , is a coupling strap of iron, which connects the crank M , and the moveable bar o, o , together, which is kept in its place by means of the sliding hooks P, P , working in the brass sockets Q, Q , which are screwed upon the strong iron supports R, R . It is obvious that as the crank M , revolves, it will, by pulling the connecting rod N , give a perpetual motion backwards and forwards to the moveable bar o, o . In order that there may be as little friction as possible to the moveable bar o, o , there are two friction pulleys fixed to the iron supports R, R , upon which the moveable bar o, o , rests. These are not seen in the Plate, as they are placed immediately below the bar ; but to any person who considers the thing attentively, they must be readily understood. They are of the greatest consequence, as the back parts of the cutters wholly rest upon the moveable bar o, o ; and from the spring which each cutter must necessarily have, the pressure upon it is very considerable. With respect to the cutters, it may here be remarked, that the greater body of them is made of iron, edged with the best steel, hardened as much as they will bear, without breaking out into chips when the machine is in operation. The cutter bar (that is, the bar upon which the cutters are screwed) is strongly screwed upon the extremities of the supports R, R , and is six feet long by three inches broad, and three-fourths of an inch thick. The lower or fixed cutters s, s, s , are made triangular, of solid iron, edged with steel as before mentioned ; they are fifteen inches long from the point to the extremity, four inches broad at the base, and nearly one-fourth of an inch thick ; they are steeled only to the front of the bar, thus leaving a steeled edge of about one foot. In the middle of the base of the cutter there is a hole pierced, half an inch in diameter, and a corresponding one in the bar where it is to be placed. The hole in the bar is screwed ; and, in fixing a cutter, a bolt is passed through the hole in the base, and screwed tightly down into the bar. To prevent a cutter from shifting its place, there are other two small holes pierced, one on each side of the half inch

hole in the base, and corresponding ones in the centre of the bar : these holes are one-fourth of an inch in diameter. Into the holes in the bar there are two iron pins firmly rivetted below, and left one eighth of an inch above the bar, made to fit neatly into the holes in the cutters, although with a sufficiency of looseness to allow the cutter to be taken easily off, when the bolt in the middle is screwed out. By this means, when the bolt in the middle is screwed down, a firm and unalterable position is ensured to the under cutter. The upper cutters *u, u, &c.*, like the under ones, are made of good iron, edged with steel as far back as the hole where the bolts upon which they turn pass through. They are three inches broad where the hole is pierced ; and, behind the cutter bar, as is seen in the Plate, they are bent down about two inches, to allow the rollers and canvass to operate, as shall be afterwards described. After being continued horizontally about three inches, they are again bent up, and their extremities placed above the moveable bar. They are made about $13\frac{1}{2}$ inches long, from the point to the hole, and about $7\frac{1}{2}$ inches from the hole to the extremity backwards. Both upper and under cutters are sharpened on both sides, similarly to a pair of scissors ; the under ones, of course, upon the upper side, and the upper ones upon the lower side ; thus forming, when the cutters are screwed to their places, a perpetual cutter upon that principle. The bolts upon which the upper or moveable cutters work are half an inch in diameter, and are screwed to the bar through a hole of corresponding breadth ; they are made to go through the bar about half an inch, upon which a nut is screwed, to prevent the bolts from unscrewing, which they would otherwise do, from the moving of the cutters ; which would allow the edges of the cutters to separate, and of course the machine would get deranged, and would not operate. The points of the under or fixed cutters are six inches separate ; of course the holes in the bar, by which they are fixed, are six inches apart. The bolts of the upper or moveable cutters are intermediate, that is, three inches from the others ; so that the cutter bar is bored from end to end, with holes half an inch in diameter, and three inches distant. The small holes, with the pins which prevent the fixed cutters from shifting their places, are each $1\frac{1}{2}$ inch from the large holes ; so that the bar, before the cutters are screwed upon it, is pierced, first with a small hole, then

a large one, then two small ones, then a large one, then two small ones, &c, as may be understood from the Plate; each hole $1\frac{1}{2}$ inch apart. The back parts of the moveable cutters, as is already mentioned, rest upon the moveable bar; and on each side of every cutter there is an iron pin, of one-fourth of an inch in diameter, rivetted into the moveable bar. By means of these pins, it is easily seen, from the consideration of the Plate, that, as the moveable bar is pushed backwards and forwards by the crank *m*, upon the friction pulleys below it, the moveable cutters will have a perpetual motion backwards and forwards. Under the heads of the bolts, which fasten the moveable cutters, and the cutters themselves, there is placed a washer of brass, to diminish the friction as much as possible; and, for the admission of oil, there are two small holes pierced in the head of each bolt. There are twelve moveable cutters, and thirteen fixed ones, with intervals of six inches between the points of the latter; so that the breadth of the machine is exactly six feet; but this breadth, from the principle of the machine, may be either increased or diminished, according to the nature of the farm upon which the machine is intended to operate. Upon a perfectly level farm, the machine might be made broader; but upon a farm of sloping or uneven surface, one of six feet in breadth will be found to be work enough for two horses. As it was before stated, the bevilled wheel *i*, gives motion to the coupling wheels *L, L*, of eighteen teeth each; these move the horizontal shaft *v*, and the wheel *w*, which is fixed to the end of it. The wheel *w*, has thirty-six teeth; and pinion *x*, which it turns, and which is fixed upon the gudgeon of the roller *y*, has eighteen teeth. This part, however, is misrepresented in the drawing, which was taken from a model which had the rollers turned by coupling wheels, as shewn in the plate. The one roller, *y*, turns the other, *z*, by the pitch chains *a, a*, the chief use of which is to keep the sheet of canvass from changing its place by the revolution of the rollers. The canvass, from its gravity, would slip down upon the rollers as the machine moved forward; and it would twist upon them, by the unequal pressure to which it is exposed by the cut corn pressing unequally upon it. To prevent these derangements, there are loops fixed to the canvass, which are made fast to the links of the chain, about six inches apart; and there being an equal number of links in both

the upper and lower chains, and an equal number of teeth in the four pulleys upon which they work, the canvass revolves uniformly, without being in the least deranged by the many casualties to which it is exposed. *b*, is the pole to which the horses are yoked: it is made of wood, and is firmly fixed to the cross rails upon the top of the frame: its length is ten feet from its extremity to the frame of the machine. *c, c*, are the swingle-trees, by which the horses are yoked: they are yoked similarly to horses in a carriage, so as both to draw forward or push backward at pleasure. Their heads, of course, are towards the machine; and in appearance, they push the machine before them, but, in reality, they are drawing the same as in the plough. *d*, is a small rod of wood, or *helm*, which the driver holds in his right hand, by the pulling of which to him, or pushing it from him, he conducts the machine straight forward. The dotted lines in the Plate are a continuation of the pole with the swingle-trees and helm attached. The machine is turned at the end of the ridge by the following contrivance:—The two wheels *e, e*, in the body of the machine, are jointed to the lever *f*, by an upright moveable axle. These wheels are similar to the two *c, c*, on the front of the frame: they have a strong iron axle, which is made so long as to let the wheels conveniently turn between the crank-rod *k*, and the frame of the machine. In order that this piece of apparatus may be used with advantage, the bevilled wheel *i*, is not placed upon the middle of the main axle *n*, but about one foot from the end of it, as is seen in the engraving. This throws the crank-rod *k*, nearer the side of the machine, thus leaving plenty of space for the turning apparatus. In the middle of the horizontal axle of the wheels *e, e*, there is an upright standard of iron, sufficiently strong and firmly joined to the horizontal axle. This upright standard or axle passes through the middle of the lever *f*, (which is of wood, and, at this part, about five inches square,) about twenty inches from the end of it. Upon the top of the upright standard there is placed a segment of a wheel *i*, with the teeth on the lower side, which is worked by a small pinion of six teeth upon the end of the rod *g*. This pinion is not seen in the engraving, as it is completely concealed by the segment *i*. The rod *g*, and the small pinion upon it, are turned round by the handle *h*; the pinion moves the segment *i*, which, being firmly fixed to the upright standard,

turns the small wheels *e, e*, either way. When the machine is cutting, the wheels *e, e*, are put parallel to the cutters; and in this position they assist the machine in passing a furrow, without allowing the cutters to come in contact with the opposite side of it. But when the machine is to be turned round, they are turned with an angle to the path of the machine, by the handle *h*; and the rod *g*, being fixed in that position by a screw near the handle, the lever is then pressed down, and fixed with a catch to the frame of the machine. In pressing down the lever *f*, the small wheels *e, e*, which before were about two inches from the ground, are pressed to the earth, about two or three inches below the natural level of the machine. Of course, the two front wheels *c, c*, are lifted two or three inches from the ground, and the cutters considerably more, thus ensuring them from accident while turning round. The machine now rests upon the two large wheels *B, B*, and the two small ones, *e, e*, of the lever; and the two front wheels *c, c*, go for nothing, as they do not touch the ground. But the axle of the small wheels *e, e*, being placed with an angle to the main axle *D*, of the large wheels *B, B*, the machine will naturally turn round, upon the horses being moved slowly forward: of course, the greater the angle formed by the two axles, the less space will the machine require to turn upon. In turning the machine, however, attention must always be given to disengage the large wheels *B, B*, from the main axle *D*: this is done by shifting the coupling-boxes *E, E*, by means of the handles *H, H*. The apparatus *l, l*, or collector, is placed exactly above the cutters: it is $2\frac{1}{2}$ feet in diameter, made of wood as slight as may be. The supports *k, k*, in the original machine, were made of iron; but now the two side beams of the machine are made of a piece of wood, with a natural cast upon it, similar to the beam of a plough, but rising with a much greater angle, as near the form of the iron supports in the plate as possible, and continued horizontally till their points are exactly above the moveable bar *o, o*. The points *p, p*, are made of iron, bent as in the plate, to allow the collector *l, l*, to turn round. At *q, q, q, q*, are strong iron screws, working in nuts placed in the wooden part of the supports, which serve the double purpose of uniting the iron part to the wood, and allowing it to be drawn forward or pushed backward, as occasion may be, by either shifting to another hole, or,

which is better, by long slips in the middle of the bar. Long corn requires the collector to be placed forward, and short corn requires it to be taken back. At *o, o*, are two perpendicular rods, which slip in holes in the points of the supports, by the moving of which, upwards or downwards, the collector *l, l*, which turns in sockets in the lower ends of these rods, is lowered or heightened, according to the length of the corn to be cut. The rods are fixed in their places by screws in the ends of the supports. The collector is turned by a cross belt, or chain, passing over the two pulleys *m, n*. A piece of slight canvass is put round the rollers *x, z*, fixed to the chains *a, a*, as before described. The lower ends of the rollers have a shield of plate-iron round their gudgeons, to prevent the cut corn from warping, which it does effectually. The bushes of the roller *z*, are made to shift by screws, to tighten the chains a little, to prevent them from slipping the pulleys, as they lengthen a little by using, especially when new.

“ Fig. 376, is a representation of the machine in full operation. About six or eight yards of the field require to be cut at the ends, to allow the machine to turn without injuring the corn, which may be done by the machine itself. If the corn is standing nearly upright, a convenient number of ridges may be taken in and cut by going round them; but if the corn is standing, and the field free from deep furrows, it may be cut by going round and round it, till it is finished in the middle. One man, as seen in the Plate, is sufficient to manage the whole operation. The cutting, collecting, and laying are the three principal parts of the machine, which have been all more or less explained in the general description given above; but as they are particular, a few words on each of these heads may still be necessary, that the machine may be completely understood in all its bearings. First, then, with regard to the cutting—it is desirable that the machine should do her work, and nothing more. If the motion of the cutters were too slow, she would not clear the ground; and if it were too quick, there would be a useless expenditure of power and machinery. Let it be remembered that the large outer wheels *B, B*, are $3\frac{1}{2}$ feet in diameter, that the bevilled wheel *i*, has sixty teeth, and that the crank-rod pinion has ten, and that the cutters have twelve inches of a cutting edge. The diameter of the

wheels B, B, being $3\frac{1}{2}$ feet, or forty-two inches, their circumferences are 131·94678 inches; every revolution of them will pass over nearly 132 inches of the ground's surface; but there being ten teeth in the crank-rod pinion, and sixty in the bevilled wheel I, every revolution of the wheels B, B, will turn the crank pinion six times, and of course the crank as often. But every turn of the crank pinion gives two cuts, and each stroke of the cutters clears twelve inches of the ground, because they have twelve inches of a cutting edge; therefore, one revolution of the wheels B, B, gives twelve strokes of the cutters, and clears twelve times twelve, or 144 inches of the surface of the ground. But one revolution of B, B, passes only over 132 inches of surface, therefore the cutters are calculated to cut, in one revolution of B, B, twelve inches more than enough—that is, one inch each stroke. This, however, is perhaps nothing more than is advisable to calculate upon, making allowances for the operation of the machinery, the partial dragging of the wheels, &c., &c. Secondly, the collector *l, l*, must not move too slowly, lest it should retard the corn from falling upon the canvass; and it must not move too quickly, lest it should shake ripe grain. As before stated, it is $2\frac{1}{2}$ feet in diameter, that is, 94·2477 inches in circumference. But one revolution of B, B, passes over 132 inches of surface; therefore, that the collector *l, l*, may just touch the corn, without bringing it back or retarding it from naturally falling back, it must make 1·4 revolution for every one that B, B, makes. Since there are six arms in *l, l*, every arm will touch the standing corn at equal distances of 15·7 inches. The pulley *m*, makes six revolutions for one that B, B, makes; it is six inches in diameter, and the pulley *n*, upon the axle of *l, l*, is nine inches; therefore *m*, revolves 1·5 times for once that *n*, turns round, and the collector *l, l*, revolves four times for once that the large wheels B, B, revolve. But $4 \times 94 \cdot 2477 = 376 \cdot 99$ inches, the space passed through by the circumference of the collector, while the machine moves forward only 132; the difference of which is 244·99, the space that the collector passes over more than the machine, during one revolution of B, B. Therefore, every inch of the corn is brought back 1·54 inch nearly by the collector, which is sufficient to ensure its falling backwards upon the canvass; and yet it touches the corn so gently, that it is impossible that it can injure it in the smallest degree. A

quicker and a slower motion, however, is advisable ; which is easily given, by having two or three sheaves upon the pulleys *m*, and *n*, and then, by shifting the belt, a different motion is produced. With regard to the canvass, it is necessary that it should revolve as much as the ground passed over by the machine : that is, while the wheels *B, B*, make one revolution, or pass over 132 inches of the surface, 132 inches, at least, of canvass should pass over the rollers. *w*, as before stated, has thirty-six teeth, and *x*, eighteen ; so that the roller *x*, will give two revolutions for one of *w*. But *w*, revolves six times for one revolution of the wheels *B, B* ; hence the roller *x*, will revolve twelve times for every revolution of *B, B*. The diameter of the rollers is four inches, their circumferences therefore are nearly 12·56 inches, twelve revolutions of which will give 150·72 inches. As before stated, one revolution of *B, B*, gives only 132 inches ; wherefore there is a preponderance of motion, on the side of the canvass, of 18·72 inches for every revolution of *B, B*. This velocity is necessary to ensure the canvass of clearing itself in all cases ; and, with a smart velocity, the cut corn is laid down with a greater angle to the path of the machine. It may here be observed, that it is often found convenient to have the canvass to lay down the corn on either side of the machine, according to the direction from which the wind is blowing. This may be done with a double wheel at *x*, with a handle, in the usual method employed for reversing the motion of the rollers of the thrashing machine. It were desirable too, if possible, to have the canvass besmeared with a drying oil or gum, or some other substance, which would prevent it from contracting with moisture ; as the slightest shower, or dew of a morning, contracts it so much as to render the implement useless until the corn is perfectly dry.

“ An estimate of the probable value of Bell's reaping machine may be formed from the reports, signed by numerous practical farmers, who were spectators to different trials made in 1828 and 1829. In September, 1828, the machine was tried at Powrie, in the county of Forfar, before between forty and fifty landed proprietors and practical agriculturists, who signed a declaration, stating “ that the machine cut down a breadth of five feet at once, was moved by a single horse, and attended by from six to eight persons, to tie up the corn ; and

that the field was reaped by this force at the rate of an imperial acre per hour."—*Gard. Mag.* vol. v. p. 600.

"In September, 1829, the machine was tried at Monckie, in Forfarshire, in the presence of a still greater number of persons, who attest that it cut, in half an hour, nearly half an English acre of a very heavy crop of oats, which were lodged, thrown about by the wind, and exceedingly difficult to harvest. It was tried in a number of other places in Forfarshire, Perthshire, and Fifeshire; and the general conviction appears to be, that it will soon come into as general use among farmers as the thrashing machine.—*Gard. Mag.* vol. vi.

"The price is at present between £30 and £35; but if it were once in general use, probably the cost might be lowered; but even that price would be saved out of the usual sum paid for manual labour, during only one harvest, by an extensive farmer."

The above description of Bell's machine, in Loudon's *Encyclopædia of Agriculture*, is succeeded, at p. 427, by the following explanation (illustrated by Plate XVI.,) of Gladstone's machine for reaping beans:—

"Gladstone's machine for reaping beans (Fig. 378) has been used in several parts of Scotland with complete success. The framework of this machine is the same as that of a common plough. To this is added the knife *a*, which is a plate of steel, screwed to a piece of wood, to keep it from bending up and down; this wood being screwed to the framework. There is a wheel *b*, to keep the knife, when in motion, in a horizontal position. The cutting edge of the knife *c*, has teeth, or serratures, on the upper side *d*; the under side *e*, is flat. One horse and a man will cut with this machine from four to five acres a day with ease, and perform the work as perfectly as by manual labour."

In 1828, a copious and very interesting essay on "the use and advantages of a reaping machine," was published in the *Quarterly Journal of Agriculture*, vol. i. page 136.

Letters Patent (No. 6081) were granted on the thirty-first of August, 1830, to Edward Budding, of Thrupp, near Stroud, for "a new combination and application of machinery for the purpose of cropping or shearing the vegetable surface of lawns, grass-plats of pleasure grounds, constituting a machine which may be used with advantage, instead of a scythe, for that purpose."

On the second of November, 1840, (No. 8757) to John Duncan, of Great George Street, Westminster, for "improvements in machinery for cutting, reaping, or severing grass, grain, corn, or other like growing plants or herbs,"—being a communication.

On the twentieth of May, 1841, (No. 9051) to Charles Phillips, of Chipping Norton, for "improvements in reaping and cutting vegetable substances as food for cattle."

On the third of July, 1843, (No. 9899) to Charles Phillips, of Chipping Norton, for "improvements in apparatus or machinery for cutting corn, grass, and such like standing or growing crops, and in apparatus or machinery for cutting vegetable substances as food for cattle."

A machine for reaping, thrashing, winnowing, &c., was produced in South Australia by Mr. Ridley, in 1845, and is thus described in Wilkinson's Working Man's Hand-book to South Australia, at p. 40 :—

"It is a true saying, 'that necessity is the mother of invention;' and so it was in this case particularly, for in 1845 appeared a machine invented by Mr. Ridley, a colonist, and manufactured in Adelaide, which being driven before bullocks or horses through the standing corn, plucked off the ears, beat the grain from the husk, then winnowing it as it went along, turned it out into bags at the other end of the field ready for the market. This was all performed very rapidly, and at an expense of about seven shillings per acre. Within the last few weeks I have seen an American publication, which mentions this same useful machine, and takes all the credit of the invention for one of the Yankees. Her Majesty and Prince Albert have been pleased to express to Mr. Ridley their admiration of the value and importance of this invention, and the Royal Agricultural Society of England have also very much admired and approved of it."*

Since the above date, the following Letters Patent have been granted for Inventions relating solely or partially to reaping and mowing machines :—

On the twenty-second of August, 1846, (No. 11,436) to Matthew Gibson, of Newcastle-upon-Tyne, for "a machine for reaping, cutting grass, and other similar purposes."

On the fourteenth of October, 1847, (11,984) to Sir John Scott

* A further account of this machine is given at p. 107.

Lillie, of Fulham, for "improvements in machinery applicable to tillage, and for other agricultural purposes."

On the nineteenth of December, 1849, (12,988) to Joseph Whitworth, of Manchester, for "certain improvements in machinery or apparatus for cutting metals, and also improvements in machinery or apparatus applicable to agricultural and sanitary purposes."

On the seventh of December, 1850, (No. 13,476) to Richard Archibald Brooman, of Fleet Street, for "improvements in agricultural machines,"—being a communication. The machine which forms the subject of this Patent is that known as "Mc Cormick's Reaper."

The Great Exhibition of 1851 brought into public notice a variety of reaping and mowing machines, either in the form of full-size working implements or models. The following account of the implements of this class contained in the Great Exhibition is extracted from vol. xl. of the London Journal of Arts, Sciences, and Manufactures :—

"The inconvenience to which agriculturists are subjected, in gathering in their cereal crops, from the want of an immediate and adequate supply of reapers when the weather is most favorable for their operation, has induced many ingenious men, during the present century, to turn their attention to the subject, with the view of substituting self-acting machinery for the sickle and the scythe. The most successful among the early attempts at reaping by mechanical means, seem to have been those of Mr. Smith, of Deanston (a man renowned in the annals of agriculture), and the Rev. Patrick Bell. A description of the machines invented by these gentlemen is published in *Loudon's Encyclopædia of Agriculture*; from which it appears, that the first trial of Mr. Smith's machine took place during the harvest of 1811, and that Mr. Bell's was publicly tested in 1828; but, although fair results were in each case obtained, they were, from some unexplained cause, abandoned by their inventors, and were, consequently, lost sight of by the public;—thus affording another instance, if such were wanted, of the utter inutility to the general public of the most valuable suggestions, unless thrust upon their notice by some party who is pecuniarily interested in introducing them in a practical form. That these machines contained the elements necessary for an efficient reaper there can be no doubt; and

it is, perhaps, owing to this fact, that nothing was done by independent parties to bring them into use. But, however this may be, it is evident that neither the requirements of the farmer, nor the prospect of reward to agricultural implement makers, were sufficient to awaken public attention to the national importance of reaping by mechanical means. The credit of effecting this step in advance is undoubtedly due to our transatlantic brethren, whatever may be the ground for disputing the novelty of the two rival American reapers, which, from the practical illustrations of their efficiency, have of late excited so much interest in the agricultural world; and there is little doubt that, at the coming harvest, manual labour will be, in great part, superseded by this class of machinery.

“The first of the reaping machines which we shall notice, as contributed to the Great Exhibition, is Mr. McCormick’s: this was contained in the American department, and to it a Council medal was awarded. It consists of a triangular wooden frame, mounted on a small running wheel with a broad tire, and having a pole and whippetrees secured to the fore part thereof. The back rail of the frame projects horizontally on the left or near side to the extent of about six feet, and forms the front part of a platform, of like breadth, and nearly five feet deep, which is supported on the further side by a wheel of less diameter than the first-named. From the front edge of the platform numerous fingers or prongs, shaped like the head of a spear, project in a horizontal position, at equal distances apart. Close under these prongs is a thin steel cutting blade, which extends across the front of the platform, and receives a reciprocating motion from right to left (as the machine is drawn onward) by its connection with a crank on a small upright shaft, driven by bevil gearing from the axle of the first-named running wheel. The front edge of the blade is either straight or of a zig-zag form: in either case it is notched or toothed, like a sickle, and divided into sections corresponding to the number of fingers,—each section having one half of the teeth inclined in one direction, and the other half in the opposite direction. Above the front edge of the platform there is a reel or gatherer, consisting of four wooden vanes or blades, (about six feet long and nine or ten inches wide,) carried by arms from a horizontal shaft, which is driven by an endless band, that transmits rotary mo-

tion from the rim of a wheel on the axle of the larger running wheel to a pulley on the reel-shaft. The use of this reel is to keep the corn, while being cut, in contact with the cutting blade. To the side of the triangular frame is affixed a wheel-board or guide, which turns the standing corn inwards on the off side of the platform; and, on the near side, there is another guide or separator, which turns inwards the corn that is before the machine, and puts aside the corn that is not to be cut until the next time that the machine passes around the field. The triangular frame supports a seat for the man who drives the horses that draw the machine, and one for the man who gathers the grain from the platform as it is cut. The operation of reaping with this machine is as follows:—The machine is brought to the edge of the field, with the platform in front and the horses at the side of the crop to be cut down;—part of the corn being first cut away by hand, at the edge of the field, to form a path for the horses. As it is drawn onward, the reel rotates slowly, and the knife or cutting blade moves rapidly to and fro; the fingers receive the standing corn in the spaces between them, and hold the stalks while the knife severs them (which operation is assisted by the blades of the reel inclining the corn towards the platform); and, as the cut corn falls on to the platform, it is raked, in quantities sufficient to form a sheaf, on to the ground at the off side of the machine. A clear space is thereby left for the return of the reaper, in case the binding of the sheaves may not have kept pace with its progress.

“The American department also contained another reaping machine, the invention of Mr. Hussey; and, from the fact of its missing the Council medal, it was generally supposed to be inferior to Mr. McCormick's: the latter gentleman, however, not content with having virtually beaten all the world, in an evil hour suggested the means of beating himself, by challenging all competitors to meet him in the field, and prove the quality of their implements. This challenge was accepted by his fellow countryman, Mr. Hussey; and the result of the trial, which came off before a jury of the Cleveland Agricultural Society, is thus reported by the *Gateshead Observer*:—‘The laurels so recently placed upon the brow of Mr. McCormick, have been plucked off—not wholly, but in great part—by his fellow countryman, Mr. Hussey. Both machines proved their ability to do

good work ; but Mr. Hussey's attested its superiority ; and the English farmer has now seen, thanks to Prince Albert and the Exhibition of the Works of Industry, that his corn and grasses, hitherto slowly and laboriously reaped with the sickle and the scythe, may be *planed* off the land, in five feet breadths, as rapidly as a horse can trot.'

" In Mr. Hussey's machine, the platform is fixed to the side of, and parallel with, the frame to which the pole and whippletrees are connected ; it is furnished with suitable guides at each side, to direct the standing corn ; and it is supported on the near side by a small wheel, and on the off side by the larger wheel of the side frame, from which a reciprocating motion is imparted to the cutters by suitable gearing. The principal points in which this machine differs from the preceding one are, that a different arrangement of cutting apparatus is adopted, and the rotating reel is dispensed with. The cutting apparatus consists of a series of small cutters, of a lancet or triangular form, with sharp edges, affixed to a reciprocating bar, which occupies the place of the cutting blade in the other machine, and is worked in like manner from the axle of the larger running wheel. To the front edge of the platform are fixed as many prongs or tines as there are cutters ; these prongs are doubled or bent back again upon themselves, and thus form spaces through which the cutters may pass ; and, when the machine is in motion, the several cutters alternately pass from the centre of one prong to the centre of the next and back again, so as to act with such prongs in the manner of the moveable and fixed jaws of a pair of shears, and cut through the stalks of corn which enter between them. An attendant sits upon the side frame, and, with a peculiar kind of rake, he pushes off the cut corn, in quantities equal to the size of a sheaf, from the back of the machine, instead of from the side, as in the former case. The head of the rake, in which the teeth are inserted, is of the ordinary form ; but the handle, instead of standing out at right angles to the side of the head, is fixed in an inclined position (sidewise) to the top of the same. The action of the attendant, when using the rake, is similar to that of a man paddling at the side of a canoe. The man or boy who drives the horses does not sit on the machine, but rides the near-side horse, in the manner of a postilion.

" Messrs. Garrett and Son contributed a reaping machine of their

manufacture, termed the 'Tollemache Corn Reaping Machine,' from its introduction into this country from the United States by J. Tollemache, Esq. M.P. Its construction, with some modifications, is similar to that just described. The machine is drawn by two horses, placed one before the other,—the hind horse working in a pair of shafts, affixed to the side frame, which is, in this instance, on the near side of the platform; whereby the boy that drives the horses is enabled to walk at the near side of them (as usual) on the land from which the corn has been cut; and this he could not do if the frame were on the off side, as in the two preceding machines.

"This machine, like the others, was tried publicly last harvest; and, with the addition of a tail platform, was found to act very satisfactorily,—delivering the corn out at the side instead of the end of the machine. Some credit is due to Messrs. Garrett for being the first to re-introduce, if we may so say, reaping machines to the public; and also for resisting an attempt which was recently made to impose a tax on the public by means of a patent right for the use of some improvements, the benefits of which they had previously given to the world.

"Mr. Blaikie, of 71, Stockwell Street, Glasgow, exhibited a model of a reaping and mowing machine, consisting of a horizontal metal frame, of a triangular form, which carries two long straight blades or knives, affixed to the sides thereof, and meeting at the forward end of the triangle, from which a bent piece of metal, resembling the front end of a skate iron, depends, for the purpose of preventing the end of the frame from ploughing into the soil. The frame is suspended from a pair of large wheels, which travel within it. Behind the machine there is a pair of reversed shafts, in which a horse is placed and connected thereto, so as to push the apparatus onward, and thereby cause the two knives to come in contact with and cut down the corn on either side of the machine. The shafts are affixed to the end of a long bar, which is connected to the axle of the running wheels by a centre pin; and to a short extension of the bar, beyond the pin, is fastened an upright rod, with a pair of handles at the top; by means of which, the attendant, who sits in a seat directly over the axle, can guide the machine.

"Among the French agricultural implements, there was a model

of a reaping and mowing machine, which, from its construction, formed a connecting link between the preceding ones and those of the rotary class, which we shall presently describe. The frame of this machine takes the form of a right angled triangle,—the inclined side of the triangle constituting the off side of the frame. It is supported by a small wheel or roller at the fore part, and by a pair of large wheels at the back, where it is also furnished with a pair of handles, by which it is pushed forward. To the near side of the frame, midway between the fore wheel and the near hind wheel, is attached a horizontal tapering knife; and a similar horizontal knife is fixed to the same side of the frame, in such a position as to form, with the other blade, an angle of about 60° ;—the two knives presenting an appearance similar to that of a pair of scissor-blades, opened ready for cutting. Above the first-named knife, a vertical spindle is supported by the frame; rotary motion is imparted to it by gearing connected with the hind wheels; and two curved horizontal blades, which it carries, are thereby caused to act with the fixed blades in the manner of shears, and cut through the stalks of the corn standing between them. A horizontal rod or bar extends from the back part of the frame, on the near side, nearly at right angles thereto, and carries a blade, which projects backward towards the frame: it is apparently designed to lay the cut corn in rows or swathes ready for binding.

“Mr. Taylor, of Bury, Lancashire, exhibited a small machine for cutting corn, designed to be worked by hand. It consists of a low wooden carriage, mounted on four small wheels; at the centre there is an upright spindle, supporting a plate or disc, from which a horizontal arm projects through a long opening in the fore part of the carriage; and, to the outer end of the arm, is affixed a scythe, furnished with a ‘cradle’ for laying the cut corn in rows for binding. On the top of the spindle there is a cross bar or handle; by means of which, the operator causes the scythe alternately to move through the half of a circle—cutting down all the corn in its path—and then to move back again into the proper position for commencing a fresh cut. By means of suitable gearing, connecting the upright spindle with the small running wheels, the carriage is made to travel onward a short distance during the backward movement of the scythe.

“ A model of a simple rotary mowing or reaping machine was contributed by Mr. Mackay, of Swansea. The framing of this implement is suspended from the axle of a pair of running wheels, and is furnished at the back with a pair of handles ; at the lower part of the frame there is a cutting-blade (shaped somewhat similar to an S, or, as it may be termed, a double scythe), affixed to a short vertical shaft, connected by wheelwork with the axle of the running wheels ; and, therefore, as the machine is impelled onwards, the blade or scythe is caused to rotate and cut down the standing corn which it meets in its progress.

“ Mr. Fairless, of Corbridge, Northumberland, exhibited a machine of a similar character to the preceding one. In this instance, however, the frame is mounted on four low wheels, and to the hinder part of it is attached a pair of shafts, in which a horse is placed in a reverse position, so as to push instead of draw the machine. At the front of the frame there is a vertical spindle, to which motion is transmitted by gearing from the axle of the fore wheels ; and, to the lower end of the spindle, a horizontal arm is fixed, at the middle of its length, for the purpose of carrying, at each end, a curved horizontal blade, which, as the spindle revolves, cuts down the corn.

“ A model of a machine for reaping corn was deposited in the Exhibition by Mr. Trotter, of Bywell, Stocksfield, near Gateshead. It consists of a long rectangular wooden frame, carried by a pair of hind wheels and a single swivel fore wheel. At the centre of the machine there is a revolving vertical shaft, cranked at the lower end ; upon the shaft, above the crank, is fixed a frame, consisting of a boss, with four arms projecting radially therefrom ; and, on the crank pin, is fitted another boss with four radial arms : therefore, as the shaft revolves, the frame carried by the crank pin will move eccentrically to the first-mentioned frame. The corn is cut by four straight double-edged knives ; each knife being affixed at the butt end to a short upright stem, cranked at the top. The stem is carried by an arm of the lower frame, and its crank pin is connected to the end of an arm of the upper frame ; and thus a kind of parallel motion is produced, that causes each knife, as it is successively brought by the revolution of the shaft to the side of the machine, to assume a suitable position for cutting down the corn standing in its way.

“ Mr. Winder, of Ingram Court, Fenchurch Street, contributed a model of a machine for reaping corn or mowing grass, having a frame like an ordinary cart frame, running on two wheels, and impelled by either one or two horses at the back. The wheels are affixed to separate short axles; and the inner ends of the axles are connected by wheelwork with the vertical spindles of two horizontal circular knives or cutting discs. Motion is thus transmitted from the travelling wheels to the circular knives, which overlap each other, and act like rotary shears to cut the corn or grass near the surface of the earth. The two projecting parts of the frame, that carry the spindles of the knives, are furnished with upright bent metal plates or guides, by which the cut corn is caused to fall in the space between them, and to lie on the ground in rows or swathes. Between the guides there is a horizontal metal plate, with a ridge along the centre, which assists in guiding the cut corn.

“ A model of a mowing and tedding machine was shown by Messrs. Beckford and Gosling, of Highfield Farm, Henley-on-Thames. This apparatus is designed to perform, simultaneously, the operations of mowing grass and making hay; or either part of it may be put into action independently of the other part. The body of the machine is carried by a pair of large hind wheels and a single swivel fore wheel, and is furnished, in front, with a pair of shafts for a horse. On the off side of the body is the mowing apparatus, consisting of a low metal cylinder, with a ledge at the bottom, from which four curved blades project horizontally; and the requisite rotary movement, in order to cut the grass, is imparted to the cylinder and blades by gearing from the off side hind wheel. In order that the height at which the curved blades cut the grass may be regulated, the vertical spindle of the cylinder is connected to the end of a lever, that turns on a horizontal axis or fulcrum; and the other end of the lever is extended beneath the seat of the driver, who, by pressing on the end of the lever with his foot, can raise the knives to the desired height. The hay-making apparatus is situate on the near side of the machine; it is of the ordinary construction, consisting of a revolving cylindrical frame, with six rows of projecting teeth, which catch and throw over the grass; and motion is communicated to the axle of the cylindrical frame by gearing from the near side wheel.

“Implements for mowing lawns, pleasure-grounds, &c., constructed on the plan invented by Mr. Budding, were contributed by Messrs. Ferrabee and Sons, Ransomes and May, Cottam and Hallen, Richmond and Chandler, and Shanks and Son. Budding's grass cutter consists of an iron frame, somewhat resembling a sack barrow, but running upon a large iron roller, instead of a small pair of wheels, when it is pushed forward by the attendant, who grasps the handles at the upper end of the frame. Across the lower end of the frame a straight blade of steel is fixed in a horizontal position; above this blade there is a rotary cutter, consisting of a horizontal spindle, carrying three rings, whereon several helical cutting blades are fixed; and this helical cutter, being caused to rotate by gearing from the axle of the roller, acts with the fixed blade in like manner to the apparatus used for shearing cloth, and cuts the grass which comes in contact with the fixed blade as the apparatus moves forward. The height at which the grass is cut is regulated by a small roller, attached to the frame, and travelling on the ground between the large roller and the cutters, so as to support the straight cutting blade at the desired elevation above the surface;—the bearings of the roller being adjusted by set screws for that purpose. The grass, as it is severed by the cutters, is delivered into a shallow box, affixed to the fore part of the frame, so that none of the cut grass is left upon the lawn. This implement may be used by persons who have not the slightest knowledge of the art of mowing; it leaves neither seams nor bare places, which frequently result from the use of the scythe; and, as the grass can be cut by it when dry, it may be employed at any time.

“In concluding our analytical sketch of the reaping and mowing machines contributed to the Crystal Palace, we may remark, that—besides affording an opportunity for the display of many new and ingenious contrivances, calculated to assist the farmer in the performance of a very arduous and important operation at a time when he is the least able to obtain manual assistance—the Great Exhibition has also been the means of drawing attention so prominently to the subject of applying machinery to this, the only operation on the farm that is solely dependent on manual labor, that there is little danger of the labors of ingenious inventors in this branch of the

mechanical arts being a second time neglected and lost to the public. On the contrary, we have every reason to hope that, before many harvests are past, reaping and grass cutting machines will be in as general use as the thrashing machine; and that the sickle and the scythe may be hung up, in company with the flail, as a remembrance of the past."

The Number of the Artizan for November, 1851, contained the following description (with the drawings in Plate XVII.,) of the Tollemache reaping machine, as improved by Messrs. Garrett and Son:—

"It is hard to say which has attracted most attention, amongst the American contributions to the Great Exhibition, Mr. Hobbs' lock or the reaping machines. We have a strong suspicion, however, that the latter will turn out the best speculation; at least if we may judge from the numerous orders which have been given for them, by those agriculturists who have the money to spare. We knew by report that our American friends were very happy in designing labour-saving machines, such as self-rocking cradles, &c.; and we shared in the general disappointment, at the opening of the Exhibition, at the scantiness of their contributions to the 'World's Fair,' as they delight to call it. What they lacked in quantity, however, they made up in quality; and after supplying us with as much bread stuff as we needed in the hour of scarcity, they have now taught our farmers how to compete with them in price, and in the right way, not by cutting down wages, but by the assistance of machinery. In this particular instance, however, we are not indebted exclusively to the Exhibition for the reaping machine. Its introduction reminds us of Dr. Goldsmith's proposal to travel in the East, and bring home such arts and sciences as might exist there unknown to us. Johnson, with his usual depreciation of poor 'Goldy,' remarked that he would go to the East and bring home a grinding barrow, as a great novelty. The traveller in this case, Mr. Tollemache, M.P. was more fortunate. In his travels in the United States he saw and admired the reaping machine, and, on his return to this country, gave Messrs. Garrett and Son, the eminent agricultural engineers, such a description of it as to enable them to construct one; and experience has since suggested some further improvements.

"The accompanying sketch and the plan (the latter drawn to a scale of $\frac{1}{2}$ inch to a foot) will clearly explain the details. The machine is carried by two wheels, *a*, and *b*; the latter communicating the driving power, through the wheel and pinion *c*, and *d*, to the bevil wheel and pinion *e*, and *f*; the crank *g*, giving the rapid reciprocating motion required by the cutters *o*, *o*. These cutters slide within slots within the stationary 'tines' (for want of a better word) *x*, *x*, which are attached to the framework of the table *z*, on which the 'raker off' stands. A 'fender,' *y*, divides the wheat as it passes along, and protects the wheel *a*. The cutters, in fact, are the teeth of a very coarse saw; whilst the tines form the support for the straw as it is cut, and thus ensure its being cut clean."

The next Letters Patent (No. 13,912), for an invention embracing an improvement in reaping machines were granted on the first of December, 1851, to William Exall, of Reading, under the title "improvements in certain agricultural implements, and in steam-engines and boilers for driving the same."

Letters Patent (No. 13,985) were also granted on the twenty-fourth of January, 1852, to George Stacey, of Uxbridge, for "certain improvements in machinery for reaping, mowing, and delivering dry or green crops."

On the twenty-seventh of January, 1852 (No. 13,999), to William Dray, of Swan Lane, Upper Thames Street, for "improvements in reaping machines,"—being a communication.

On the ninth of February, 1852 (No. 14,034), to Ralph Errington Ridley, of Hexham, Northumberland, for "improvements in cutting and reaping machines."

In the Number of the Practical Mechanic's Journal for July, 1852, there appeared the following description (with the accompanying illustration, Plate XVIII.,) of a reaping machine registered for Mr. F. Mason, of Ipswich:—

"This machine differs essentially from its celebrated American contemporary in having rotary cutters. Our Figure represents it in plan, as it would appear when the spectator is standing at the cutting end of the machine. The frame *A*, to which the shafts for drawing the machine are attached, carries a floor or platform *B*, with hinged flaps at the sides, and carrying on its front edge a series of combs or

teeth *c*. The opposite end of the frame carries bearings for a cross shaft, at the centre of which is a travelling wheel *d*, having attached to it a spur wheel for actuating the pinion *e*. The shaft of the latter carries a second wheel, in gear with a second pinion on the shaft *f*, beneath the floor. The latter shaft has upon it three pulleys, communicating motion by means of endless chains or bands to the three horizontal pulleys fast on the shafts of the horizontal rotatory cutters *g*. The cutters are capable of being engaged or disengaged at pleasure by the lever *h*, and sliding clutch. The shafts or guiding handles, by which the machine is directed, are broken away at *i*,—the machine being traversed by the drag links *j*. Those who have seen any of the existing reaping machines will easily comprehend the essential features of Mr. Mason's invention."

Letters Patent (No. 14,274) were granted on the sixth of July, 1852, to Moses Poole, of the Patent Office, for "improvements in reaping and mowing machines, and in pulverizing land,"—being a communication.

On the fifteenth of July, 1852, Letters Patent (No. 14,292) were also granted to Charles Burrell, of Thetford, and Matthew Gibson, of Newcastle-on-Tyne, for "improvements in reaping machines;" but the patentees did not enrol a Specification of their invention.

The following account of a reaping machine, registered for Messrs. W. Wray and Son, of Leeming, near Bedale, was published (with the accompanying drawing, Plate XIX.,) in the September Number of the Practical Mechanic's Journal:—

"The marked success of McCormick's reaping machine, and the still greater performances of the Hussey machine, as improved by English mechanics, may well have caused agricultural improvers to look about them. Once on the track of practical improvement, we may look forward to good results from the attention now paid to this much-neglected class of farming apparatus. Messrs. Wray's plan is amongst the latest additions to our increasing list of suggestions; and it certainly possesses superior claims, as a mechanical arrangement of originally crude notions. Our engraving represents the machine in plan. It is built up from a timber framework *A*, carried on the running wheels *B*, *C*. The cutters are actuated from the large front carrying wheel *c*, the shaft of which carries a spur wheel

D, driving a pinion E, fast on the short shaft projecting from the frame, and having on its end a bevil wheel F. Hence the motion is conveyed by a bevil pinion G, so as to drive the double crank shaft H; each crank having a connecting rod J, passing across the frame to the two long transverse cutter blades or knives K. These knives slide horizontally on fixed guides, and being notched or serrated in the usual manner, they are so set one above the other, that when at work, and moving in contrary directions, each serration acts as a pair of shears. Thus, as the machine travels forward against the standing corn, the cutting edges form their own abutment for the stalks during the severing action; and the stalks, cut exactly as they stand, fall back upon the endless travelling web, or carrier, L. This carrier cloth is extended over a pair of rollers M, N, and is made to travel continually at right angles to the path of the machine by the roller N, the spindle of which is connected, by a universal joint at O, with the shaft P. The opposite end of this shaft is connected by a pair of bevil pinions Q, and a pair of spur wheels R, with the shaft of the running wheel C. The carrier cloth travels in the direction of the arrow, and keeps up a stream of cut grain upon the delivery board S, whence the grain is raked off by hand, whenever the accumulation amounts to the necessary quantity for a sheaf. At the front outside corner of the framing a dividing iron T, is fixed, for setting out the line of cut. The horses are harnessed to a pole, attached to the narrow frame in which the front runner C, is set. This is by far the most ingenious plan of cutting action that we have ever seen. It appears to leave nothing to be desired as regards holding the stalks firm and steady for the cut, or, indeed, of cutting without the aid of any separate resisting surface."

A reaping machine, registered for Mr. William Harkes, of Lostock, Cheshire, is also described in the September Number of the *Practical Mechanic's Journal*, as follows (the description being illustrated by the accompanying Plate XX.):—

"Since writing our notice of Messrs. Wray's machine, the annexed contrivance of Mr. Harkes has been laid before us. It is carried upon a species of plough framing, A, which has a front pole, B, and transverse stay C, for the attachment of the horse. The platform D, carrying the cutting mechanism, is bolted transversely to the side of

the frame; and the whole is supported on the running wheels *E, F*. The wheel *E*, is carried on a short shaft, set in end bearings in the front rectangular portion of the main iron frame; and it has upon its shaft a spur wheel *G*, actuating a pinion *H*, fast on the inner end of the long horizontal shaft *J*. This shaft revolves in end bearings on the front edge of the platform, and is formed or fitted with a series of cams, or differential scrolls, *K*;—this detail of the apparatus, as actuating the cutters, being the essential feature of novelty in Mr. Harkes' design.

“The cutters consist of a row of spear-shaped fixed blades, set on the front edge of the platform, so as to travel along at a uniform height from the ground. The front projecting ends of these cutters are pointed, so as to effect the easy division of the standing grain, for the passage through and cut of the machine; and each cutter is caused to act as a duplex shears, by the addition of a row of oscillating cutters, *L*. These cutters are set immediately over the fixed ones, each one turning upon a stud centre of its own, and having a back notch in its plate, for the entry therein of the corresponding revolving cam *K*, of the shaft *J*, behind. Then, as the machine proceeds, the revolution of these cams gives a quick reciprocatory movement to the cutters *L*, which, like those beneath them, are double-edged, to cut both ways.

“The machine is guided, and its height of cut regulated, by the stilts or plough handles *M*; and, as the corn is severed, it falls back on the platform *D*, whence it is carried off by a self-acting rake, since added by the inventor, to clear the machine without the necessity of an attendant to follow. The whole details are well arranged, and the cut is given in the most effective manner, whilst the gearing is eminently simple.”

Letters patent (No. 14,370) were granted, on the eighteenth of September, 1852, to William Smith, of Little Woolstone, Buckinghamshire, for “improvements in machinery for reaping.”

On the first of October, 1852 (No. 79), to Henry Smith, of Stamford, Lincolnshire, for “improvements in reaping machines.”

On the second of October, 1852 (No. 169), to Moses Poole, of Serle-street, Middlesex, for “improvements in machinery for mowing and reaping,”—being a communication.

On the second of October, 1852 (No. 193), to Ralph Errington Ridley, of Hexham, Northumberland, for "improvements in cutting and reaping machines."

On the fifth of October, 1852 (No. 221), to William Crosskill, of Beverley, Yorkshire, for "improvements in machines for cutting or reaping growing corn, clover, and grass."

On the fifth of October, 1852 (No. 245), to William Dray, of Swan-lane, London Bridge, for "improvements in machinery for reaping and mowing."

On the seventh of October, 1852 (No. 14,390), to John Reed Randell, of Newtyn East, Cornwall, for "improvements in cutting and reaping machines."

On the fourteenth of October, 1852 (No. 14,394), to Richard Archibald Brooman, of Fleet-street, for "improvements in mowing, cutting, and reaping machines,"—being a communication.

On the twenty-first of October, 1852 (No. 482), to John Fowler, of Temple Gate, Bristol, for "improvements in reaping machinery."

On the thirtieth of October, 1852 (No. 579), to Alfred Vincent Newton, of Chancery-lane, for "improvements in machinery for cutting corn and other standing crops,"—being a communication.

On the third of November, 1852 (No. 626), to Charles Phillips, of Bristol, for "improvements in apparatus or machinery for reaping or cutting crops of corn, or other crops, to the cutting of which reaping machines are applicable."

On the ninth of November, 1852 (No. 697), to Obed Hussey, of Manchester, for "improvements in reaping machines."

On the twelfth of November, 1852 (No. 726), to John Henry Johnson, of Lincoln's-inn-fields, for "improvements in reaping machines, and in apparatus connected therewith,"—being a communication.

On the twenty-fifth of November, 1852 (No. 862), to Andrew Jeffrey, of Chirnside, in the county of Berwick, for "improvements in reaping machines." In this case the Patentee lodged a provisional specification; but having neglected to file a specification in pursuance of the conditions of the Letters Patent, the same became void.

In the Number of the Practical Mechanic's Journal for December, 1852, there appeared the following communication from Mr. Lewis

Gompertz, of London, containing an account (with the accompanying illustrations, Plate XXI.) of three reaping machines:—

“I cannot claim any special practical knowledge of reaping, yet I venture to forward to the *Practical Mechanic's Journal* three several reaping contrivances, which offer, I think, some advantages in point of simplicity, lightness, and absence of friction. In the first of the series, Fig. 1, A, is a large running wheel, in the form of a disc, with its index side very flatly conoidal; and B, is a horizontal steel-edged wheel or plate, set upon a short vertical spindle in the framing of the machine, which is carried on the off side by a small supporting wheel C. The disc B, is knife-edged; and this cutting edge revolves close up to the face of the wheel A,—the corn being cut between these two surfaces when directed in by the contractor D. This contractor is a longitudinal bar, recessed on one side to receive and embrace the wheel A, and sloped at each end, on the same side as the recess, in the direction of the cone of the wheel. Hence, as the machine is drawn forward over the harvest field, the contractor bends in the corn towards the wheel A, so that the straw becomes jammed between the wheel and the disc cutter. This causes the cutter to revolve, and the corn is thereby cut, there being no room for it to pass without being severed. The machine is worked by a horse attached to the shaft E;—the simple frame, F, being all that is necessary for carrying the entire mechanism. The machine and wheel C, work outside the corn, and can be so driven as to take in more or less grain, as may be desired.

“In a previous arrangement, the cutter B, merely acted against a bar, instead of the wheel A; but the present mode seems the best; as by the other one the corn was only drawn in by its contact with the cutter B, and therefore might be torn down instead of being cut; but in the present plan the cutting is facilitated by the duplex action of the wheels A, and B.

“In Fig. 2, the machine runs on a pair of parallel wheels A, B, fast on a horizontal axle, the projecting end of which carries a toothed wheel D, in gear with a counterpart wheel E, the shaft of which carries a series of scythe-shaped cutters, F. These cutters revolve with the shaft, and immediately beneath them is a second set, G, of similar shape, but stationary, and set with their cutting edges in opposition to

those of the revolving cutters. A, is the off wheel, running outside the corn, which is cut by being pressed between the two sets of cutters. Instead of the fixed set of cutters, a second reversed rotating series might be substituted ; but this would add to the complexity of the machine.

“ In the third arrangement, the cutting action is accomplished by means of a pair of shears. A, is the actuating wheel, driven by its contact with the ground. This wheel is differentially curved, and a pulley B, bears against one of its faces,—this pulley being carried in the end of an arm fast to one of a pair of oscillating shears, C, D. These shears oscillate on distinct centres, E, G, in the framing F ; and they are geared together, to work simultaneously, by the segmental toothed wheels on their upper sides. The shafts I, form the tractive apparatus ; and H, is the off wheel. Then, as the machine travels along, the action of the wheel A, on the pulley B, closes the pair of cutting blades ;—the opening for the succeeding cut being effected by the India-rubber band K, which keeps the pulley B, constantly pressed against the differentially curved surface of the wheel. The projecting ends of the blades are to be bevelled outwards, so as always to retain some straw in their grasp, otherwise they would leave much uncut.

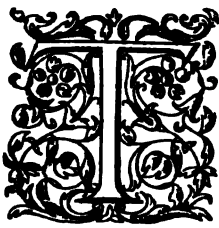
“ I have herein made no provision for laying the grain when cut ; but as all the three schemes cut sidewise, instead of running directly into the corn, such contrivance may probably be dispensed with ; if not, a shelving covering might be so applied as to pass off the corn to its proper place.

“ LEWIS GOMPERTZ.

“ *London, November, 1852.*”

On the twenty-fourth of December, 1852 (No. 1155), Letters Patent were granted to Joseph Burch, of Crag Hall, near Macclesfield, for “ certain improvements in machinery for reaping, loading, stacking, and storing grain and other agricultural produce.”

AMERICAN PATENTS FOR REAPING AND MOWING MACHINES.



THE first Patent issued in the United States of America for machinery to cut grain appears, from the Official List, to be that granted to Messrs. Richard French, and J. T. Hawkins, of New Jersey, on the 17th of May, 1803. There does not seem to have been any publication, in the United States, of this invention, nor of the inventions protected by the ten next ensuing Letters Patent relating to this subject, which are as follows :—

Samuel Adams, [no address given,] cutting grain, December 28, 1805.

John Comfort, of Bucks County, Pennsylvania, cutting grain, February 26, 1811.

William P. Claiborne, of King William County, Virginia, cutting wheat, November 8, 1811.

Peter Gaillard, of Lancaster, Pennsylvania, cutting grass, December 4, 1812.

Peter Baker, of Long Island, New York, cutting grass, February 19, 1814.

Jeremiah Bailey, of Chester County, Pennsylvania, cutting grass, February 13, 1822.*

John A. Wadsworth, of Portsmouth, Rhode Island, cutting, horse scythe, July 3, 1824.

E. Cope and J. Hoopes, jun., of Chester County, Pennsylvania, cutting grass, May 18, 1825.

* For description of this invention see page 35.

James Ten Eyck, of Bridgewater, New Jersey, cutting grain, November 2, 1825.

John S. Pleasants, of Halifax County, Virginia, cutting wheat, July 28, 1827.

In 1828, short accounts of inventions, for which Letters Patent were granted in America, appeared in the Journal of the Franklin Institute.

The following descriptions of reaping and mowing machines have been extracted from that periodical, whilst the titles and claims have been taken from the Patent Office lists.

Samuel Lane, of Hallowell, Maine, cutting grain, August 8, 1828. —“ This patent is for improvements upon machinery formerly patented. The combination of reaping and thrashing, appears rather incongruous ; but the inventor has contrived, with great ingenuity, to apply a large portion of the machine for reaping, to the purpose of thrashing, so as to include the whole in one patent. He has, also, a roller, and other appendages, moved by the same power, for the purpose of shelling corn. No clear idea of the machine can be given, without numerous and complex drawings, to which the specification refers throughout.” *Jour. Fran. Inst.* vol. ii. New Series, p. 254.

Erastus Ingersoll, of Farmington, Michigan, cutting grass, May 7, 1830.—“ Runners, bearing some resemblance to those of a sleigh, are framed together. A roller, extending across from one of these to the other, at the back part, rests upon the ground, and revolves when the machine is drawn forward. Two pieces, serving as shafts, extend forward, being secured by proper framing. The mowing or cutting part is a horizontal wheel, about 8 feet in diameter, running near to the ground, its lower gudgeon fitted in a piece framed across the runners, and its upper in one of the shaft-pieces. A band from the roller extends to a whirl on the axis of this cutting wheel, to give it motion. The cutters are knives, fitted on to the periphery of the wheel so as to form a complete circle. The claim is to ‘ the before described machine for cutting grass, grain, &c.’

“ We recollect a model of a similar machine in the Patent Office, of long standing ; but, independently of this, we apprehend that there are few grounds over which a horizontal cutting wheel of eight feet in

diameter can be drawn with advantage. Will not such a wheel be obstructed by heavy grass and grain? and will the friction of the roller on the ground be always sufficient to give it motion?" *Jour. Fran. Inst.* vol. vi. New Series, p. 75.

William Manning, of Plainfield, New Jersey, cutting grain, May 3, 1831.—“ I provide an axletree with two wheels, of the common construction. To this axletree I attach shafts, by which a horse is to draw the machine. From the axletree extend two arms, in the direction of the shafts; these arms are morticed into or otherwise attached to the axletree; they are of greater length than the shafts, extending beyond them a sufficient distance for the cutting apparatus to be entirely clear of the horse. The two arms are united together by a cross bar at their extreme ends; which cross bar, when the machine is in action, rests and slides forward on the ground. Teeth of six or eight inches in length, more or less, are set like rake-teeth, standing forward on the cross bars. These are made slender, and are for the purpose of holding the grass or grain to be cut.

“ The cutters stand immediately above the teeth, and receive a traversing motion in a way to be presently described.

“ A flat bar of iron lies along upon the cross bar, and the cutters are to be attached to this upper bar. The cutters are spear-shaped, and are sharpened on each of their edges. They may vary in their length and width, but ordinarily they may be about six inches long, and three or four wide at their bases. The grass or grain, which is held up by the teeth, passes between these knives or cutters. To give a traversing motion to them, a lever may extend from the inner end of the hub of one or both of the wheels to the cutter bar; this lever may work upon a pin at or near its centre; a zigzag groove in the hub, or in a wheel attached to it, will give it a vibratory motion, and its connexion with the cutter bar at the opposite end, will cause that to traverse.

“ I intend sometimes to make the cutters revolve instead of traversing. They are then to be fixed upon the periphery of a wheel;—the teeth being placed on a fixed semicircle. The cutters will then have one sharp edge only. The wheel may be made to revolve by bands, or gearing, from one of the main wheels, in various ways.

“ When the machine is small, it may be moved by the power of a man. The shafts may be fixed forward of the cutters, and the general arrangement be varied, without altering the main principle of my machine.

“ What I claim as my invention, and for which I ask letters patent, is the combined action of the teeth and cutters, whether the cutters are moved in a traversing or a revolving direction.” *Jour. Fran. Inst.* vol. viii. New Series, p. 195.

Richard Heath, of West Newbury, Massachusetts, cutting grass, April 26, 1833.—“ The machine which is the subject of this patent is described in a very brief way, and without any attempt whatever to designate what in it is new ; the general construction of it, however, is clearly shown by the aid of the drawing.

“ A pair of wheels is to be fitted on to an axletree of four feet in length. Two pieces of timber, ten feet in length, are to be attached firmly to the axletree, and to project forward from it in the manner of shafts,—a cross piece near their extreme ends connecting them together. Through this cross piece a vertical shaft passes, having a whirl at its upper end, and on its lower end, below the shafts, a cross, formed of two pieces of timber halved together, and intended to revolve horizontally. Each of the four ends of this cross carries a scythe,—the height of these from the ground being regulated by a small truck wheel, or roller, running under the cross. A cog wheel, upon the inside of one of the first mentioned wheels, takes into another upon a spindle, or secondary shaft, revolving above the axletree. A drum upon this shaft carries a band, which passes round the whirl on the scythe shaft, to cause it to revolve. The machine is to be moved either by hand or horse power.

“ The foregoing description is more full than that contained in the specification ; and those who know what has been done here and in Europe in the construction of mowing machines, will see that, in point of principle, there is no novelty, or in arrangement, any thing superior, in that now presented ; we might say, indeed, that whatever may be its actual performance, it is certainly, upon paper, much less promising than many of those which have preceded it.” *Jour. Fran. Inst.* vol. xii. New Series, p. 252.

Thomas A. Anderson, of Mc Minn County, Tennessee, cutting grass, &c., June 29, 1833.—“ This machine is to run upon four wheels, two of them, we suppose, may be of the ordinary size of large carriage wheels, the other two about one-third of their diameter. The large wheels are fixed upon an axle, which revolves with them ; and upon the inner side of one of them, there are cogs, which drive a wheel, turning on a vertical shaft, running in the framework of the machinery. This last wheel takes into one on a horizontal shaft, elevated above the large wheel ; this horizontal shaft extends along towards the other end of the carriage, and has on its end a vertical wheel, which turns a vertical shaft, reaching nearly down to the ground ; a scythe or cutter is secured to, and extends out at right angles from, the lower end of this shaft, and, as it revolves, is to cut the grains or grasses in its course.

“ There is no claim, the patentee probably not being aware that any similar attempts had been made to mow with apparatus of this kind ; there have, however, been many machines acting upon similar principles, though varying in form from that above noticed ; but the objections to them all are so numerous that, after a brief existence, they have made their exit.” *Jour. Fran. Inst.* vol. xii. New Series, p. 398.

William and T. Schnebly, of Hagerstown, Maryland, cutting grass, August 22, 1833. This invention was not published.

Obed Hussey, of Cincinnati, Ohio, cutting grain, December 31, 1833.—“ The mowing machine here described is to run upon wheels, attached to the frame or carriage in front of which the horses draw. From one side of the frame, a platform extends out several feet, say five or six ; and upon the front edge of this is placed the apparatus for cutting the grain ; which, as it is cut, is to fall upon the platform, whence it is to be gathered into bundles. The platform is sustained at a suitable height from the ground by means of a wheel, or roller, under the back part of the machine. The cutting apparatus consists of rows of fixed and of vibrating teeth,—the fixed teeth being, in the specification, called the guard. These teeth are to project forward from the front edge of the platform, are to be seven or eight inches long, and three inches apart ; they are nearly straight, but pointed towards their ends, and in their whole appearance resemble a large

comb or rake. The guard or comb is double, being formed of two plates of metal; but the teeth are united at the points: it is, therefore, like two combs placed one above the other, at a small distance apart,—their only connexion being the joinings of the points of the teeth. In the space between these teeth the cutting instrument is placed, and is made to vibrate: this is formed with teeth like those of a saw, but having each edge made sharp; the points of the teeth are at the same distance apart as those of the guard.

“ The main wheels of the machine are made fast upon the axle, upon which there is a toothed wheel so geared into other wheels as to give motion to a crank, which vibrates the cutters between the guard teeth; as the machine is drawn forward, therefore, the grain, or grass, is embraced between the teeth of the guard, and is cut off by the vibration of the cutters: it then falls back upon the platform.

“ In this machine the following points are claimed as new and original. 1st. The straight horizontal saw, with the teeth sharp on their two sides for cutting grain. 2nd. The guards, forming double bearers above and below the saw, whereby the cutting is made sure, whether with a sharp or dull edge,—the guards at the same time protecting the saw from rocks, or stones, or other large substance it may meet with. 3d. The peculiar construction that the saw teeth may run free, whereby the necessary pressure and consequent friction of two corresponding edges cutting together, as on the principle of scissors, is entirely avoided. 4th. The peculiar arrangement by which the horses are made to go before the machine, and the general arrangement of the parts as above described.’

“ On the 3d of May, 1831, W. Manning, of New Jersey, obtained a patent for a machine for cutting grass and grain, see vol. viii. p. 195, essentially like that now patented. The comb, it is true, is not double, in that machine; but this is not a point of importance. The cutters are perfectly similar, and are made to vibrate upon the comb. The first claim, therefore, in the present patent necessarily falls to the ground, and with it the whole superstructure. The claim in the first patent, is to ‘ the combined action of the teeth and cutters.’ We are not quite sure that the double teeth are an improvement, as there will be much danger of stubble insinuating itself within, and obstructing them.” *Jour. Fran. Inst.* vol. xiv. New Series, p. 37.

Bernard Jackson, of Brown County, Ohio, cutting wheat, June 14, 1834.—“ The description of this machine is not very clearly written ; but the drawing being well executed, its construction may be collected from the two together ; although, without the latter, we can give but a general idea of it.

“ The machine is to run upon four wheels, two of which are coupled on that end of it to which the horse is attached, and the other two at the hind or operating end. These latter wheels are made rough, to take hold of the ground, and have bevilled teeth on them, to gear into a bevil wheel upon vertical shafts. One of these vertical shafts carries four scythes, standing out at right angles from each other ; above these scythes there are fingers upon the same shaft to collect the grain. On the opposite vertical shaft, there are what are called discharging arms, which are to deposit the grain, as it is cut, behind the left side of the machine. The claim is to this combination of machinery for cutting grain.

“ However good this apparatus may prove in certain situations, like other mowing machines, it can be used only upon such land, the surface of which is uniform, and clear from stones and stumps.” *Jour. Fran. Inst.* vol. xv. New Series, p. 38.

Cyrus H. Mc Cormick, of Rockbridge County, Virginia, cutting grain, all kinds, June 21, 1834.—“ The main operating part of this machine is old ; as will be seen on referring to our remarks on the patents of T. Manning, vol. viii. p. 195, and of O. Hussey, vol. xiv. p. 37 ; and indeed there are other points in it liable to the same objection ; but when the major proposition is proved, the minor one may be left untouched. The following is a part of the claim :—

“ My claim is to the arrangement of the several parts so as to constitute the above described machine. And I particularly claim the cutting by means of a vibrating blade, operated by a crank, having the edge either smooth, or with teeth, either with stationary wires, or pieces, above and below, and projecting before it, for the purpose of staying or supporting the grain whilst cutting ; or the using a double crank, and another blade or vibratory bar, as before described, having projections before the blade or cutter, on the upper side,—both working in contrary directions, thereby lessening the friction, and liability

to wear, by dividing the motion necessary to one, between the two.' ” *Jour. Fran. Inst.* vol. xv. New Series, p. 44.

Enoch Ambler, of Root, New York, cutting grain, horse power, December 23, 1834.—“ If mere measurement is description, this machine is well described, the specification consisting of the dimensions of the respective parts, without any reference to them by letters or otherwise ; and, of course, there is no claim made ; as what is not described could not well be claimed. The drawing affords but an imperfect representation of the instrument ; and, so far as we are able to judge of it from what is shown, it is similar in principle, but inferior in construction, to several other mowing machines which have been patented.” *Jour. Fran. Inst.* vol. xvi. New Series, p. 30.

Abraham Rundell, of Verona, New York, cutting grain, and rake, April 22, 1835.—“ The difference between this and some other machines for reaping and mowing, is but small ; the grain, or grass, passes in between blades, projecting forward as it advances ; which blades vibrate, and cut like scissors. The claim is to ‘ the cutting of grain or grass with a double-acting scissors, that cut both right and left, in the manner set forth ; also the raking and discharging as described in the specification.’

“ We are very apprehensive that a moving machine, with a long array of jointed scissors, will be found too complex for advantageous use.” *Jour. Fran. Inst.* vol. xvi. New Series, p. 329.

Sturdivant and Holmes, of Portland, Maine, cutting grass, June 19, 1835.—“ Four scythes are to be made to revolve horizontally on a vertical shaft, by gearing from the wheel axles. The general plan is one of the most common for such machines, is imperfectly described and drawn, and there is no claim made.” *Jour. Fran. Inst.* vol. xvii. New Series, p. 53.

John P. Chandler, of Milton, Maine, cutting grass, August 17, 1835.—“ The framework of this machine runs upon four wheels, three of which turn freely on their axles, in the usual way ; but one of the hind wheels is employed to give motion to the mowing apparatus, by means of a wheel and band. The scythes, four in number, are attached to the periphery of a wheel which revolves horizontally below the body of the carriage. In this specification there is nothing in the

form of a claim; the general principle is not new, nor does the arrangement of the parts of the machine offer anything to bespeak a more favorable opinion of its operation than of that of several others of the kind, which have had a brief existence, and then passed into oblivion. *Jour. Fran. Inst.* vol. xvii. New Series, p. 202.

Edward Badlam, jun., of Chester, Vermont, cutting cradle for grain, September 18, 1835.—“By means of a face cog wheel on the inside of one of the wheels upon which the machine runs, motion is given to a horizontal shaft, the opposite end of which gears into a bevilled pinion on a vertical shaft, which sustains scythes, revolving horizontally. Small wheels on the underside of the fixtures of these scythes, run upon the ground, and serve to raise them over knolls; whilst springs above them keep them in their places. The grass, or grain, is received upon fingers, which conduct to a rack.

“The claim is to ‘the springs, with the fixtures for enabling the scythes to pass over small knolls; the fingers and the rack, for the purpose of catching and laying the grass and grain, after being cut by the scythes.’” *Jour. Fran. Inst.* vol. xvii. New Series, p. 263.

D. Ashmore and J. Peck, of Jefferson County, Tennessee, cutting grain, grass seed collector, September 18, 1835.—“This machine is intended to be driven forward like a wheelbarrow, when grass seeds are to be collected; but for collecting the heads of grain, horses are to be employed to *drive* the apparatus, which, in its general form, resembles a cart. The machine must be mounted upon wheels of such height as will suit the grain, or grass, the seeds of which are to be collected. The heads, as the machine advances, are to be received between a row of lancet-shaped knives, flat on the top, and bevilled to a sharp edge from below. Fingers of wood, or of metal, may also project forward, the better to guide the heads to the knives. Above the knives there is a kind of revolving reel, set in motion by bands and whirls, connected with the running wheels of the carriage; this reel, or open cylinder, carries knives, which come nearly into contact with the row of fixed knives before spoken of, which cut off the heads of the grain, or the grass. There are various appendages to, and modifications of, this machine, described in the specification, which we cannot wait to notice.

“ ‘ What we claim, as our invention, are the lanceolate knives, or, in the stead of them, the series of fingers, with other knives, to steady the grain in cutting ; the revolving wheel, with strikers, knives, and canvass ; the collecting hand with its wheels, crank, lever, rest, and adjustment ; the pulleys and band to drive the revolving wheel ; the propelling power behind ; the principle of the governor of the rudder to give direction to the machine ; and the application of the whole to the use and purpose of cutting and collecting the heads of grain, leaving the straw on the ground, and in like manner saving clover and other grass seed.’ ”

“ We believe that it will be proved, upon investigation, that this claim embraces too many particulars, and thus includes things which have been before well known and employed. Rows of lanceolate knives are not new ; the propelling from behind in grass and grain machines is not new ; the driving a wheel by a band and whirls is not by any means a fit subject for a claim ; yet there is certainly enough in the machine upon which to have procured a valid patent.” *Jour. Fran. Inst.* vol. xvii. New Series, p. 263.

Alexander M. Wilson, of Rhinebeck, New York, cutting grain, December 30, 1835*.—“ This, like some other mowing machines, is to be driven forward by a horse ; and it has on its front a horizontal revolving wheel, which carries the cutters by which the mowing, &c., is to be effected. This wheel is caused to rise with the rise of the ground, by the action of small wheels or rollers, and is itself driven by means of a band around a drum on the axle of the large wheels. There are several appendages which it would be in vain to describe without the drawing. The claim is to the fly wheel with its knives or cutters, substantially as described, together with the general arrangement of the apparatus. Similar cutter wheels have been employed ; and we do not see any thing in the general construction of this machine likely to insure its operating better than other mowing machines previously patented in this country and in Europe.” *Jour. Fran. Inst.* vol. xviii. New Series, p. 46.

E. Briggs and G. G. Carpenter, of Fort Covington, cutting and

* Renewed June 10, 1837, see p. 75.

thrashing, February 5, 1836.—“ This machine is to run on four wheels, like wagon wheels, the adhesion of the hind wheels to the ground carrying revolving scythes, a cylinder thrashing machine, and other appurtenances. The apparatus is not fully described; and we are very apprehensive that it had not been fairly tried before being patented; as we are of opinion that its promise upon paper would not be realised in the wheat field. Its power to cut, convey, thrash, and clean grain, and the satisfactory concurrent action of all its parts, would not, we think, have given it a passport to the Patent Office.

“ The claim is to ‘ the manner and principles of applying the power of a team to cutting, thrashing, and cleaning grain, by moving forward the machine; of cutting grain, of carrying it to the thrasher, of thrashing, and of cleaning grain, by power so applied.’ This claim does not, with sufficient distinctness, state the particular machinery for effecting the object, refers to no individual part of it, but appears to relate more to the end than to the means, whilst the latter is the only thing patentable.” *Jour. Fran. Inst.* vol. xviii. New Series, p. 184.

Henry Allen, of Fayetteville, Tennessee, cutting grass, June 2, 1836.

H. Moore and J. Hascall, of Kalamazoo, Michigan, cutting grain, &c. (harvesting machine) June 28, 1836.

John Drummond, of Waterford, New York, cutting grass, June 30, 1836.

William C. Greenleaf, of Andover, Maine, cutting grass, July 1, 1836.

The inventions protected by the last four Patents were not published, owing to the destruction of the Patent Office and its contents by fire, on the 15th of December, 1836.

The renewal of the Patent originally obtained by Alexander M. Wilson, December 30, 1835, is noticed as follows, together with the Patent granted to him, May 15, 1837, in the *Journal of the Franklin Institute*, vol. xxi. New Series, p. 111:—

“ This is a renewed patent, issued in consequence of the destruction of the original by fire, at the time the Patent Office was burnt. This patent was noticed at p. 48, vol. xviii. There appears to be some

discrepancy between the claims made in the original patent, as there stated, and those in the renewed instrument. The following are the words of the claim as now presented :—‘ What I claim as my invention, in the foregoing machine, is the construction of what I call the gathering wheel, with its offsets, made in the way described, and having knives or cutters attached to its lower side ; the whole formed and operating substantially in the manner herein set forth.’ ”

“ The claim under this patent [May 15, 1837], for an improvement on that last noticed, embraces a sliding gear above the gathering wheel, in combination with a hinge guard plate under the front edge of the wheel, and the clutch-box upon the shaft, to allow of the adaptation of the knives and gathering wheel to uneven ground ; and also to the manner of balancing the machine.

“ A machine very similar to this, in appearance, is shown in London’s *Encyclopædia of Agriculture*, p. 422, third edition. The gathering wheel and knives, however, are circular, instead of having breaks, as in Mr. Wilson’s. We believe that the difficulties which presented themselves in the Scotch machine have not been removed ; there appears to be too much complexity in the instrument itself, and a considerable waste of power in moving the gathering wheel and its load, where the crop is heavy.”

David Lewis, jun., of Bern, New York, cutting grass and grain, April 14, 1838.—“ In this machine, the cutting is to be effected by a single scythe, which crosses the frame from side to side, and has a vibrating motion given to it longitudinally, by means of a crank, operated on by gearing from the wheels which run on the ground. The scythe is convex towards its cutting edge ; and the grass, or grain, to be cut, is borne up against it by the revolution of a cylinder, having long projecting fingers, and which is placed sufficiently above, and in advance of, the edge of the knife, to effect the proposed object.

“ The claims made are to ‘ the particular structure of the traverse bars, and the manner of sustaining and operating the scythe, as described. The revolving comb or straightener, preceding the scythe and preparing the grain for its operation, in combination with the scythe constructed and operating as described. The hind or caster wheel, in combination as herein described, by which the hinder end

of the machine can be raised at pleasure.'” *Jour. Fran. Inst.* vol. xxiii. New Series, p. 179.

Ira Wheeler, of Salem, New Hampshire, cutting grass and grain, May 30, 1838.—“ The main feature of this machine consists of a cart (without a body), drawn forward by animal power ; and to which, on one side, is suspended a frame, containing a horizontal vertical wheel, fixed on a revolving vertical axle, around which, at the bottom, are a number of horizontal scythes, for cutting the hay, &c. ; which, as fast as it is cut, ‘ is carried round by fingers and deposited on a revolving endless apron, in the rear of the same, which conveys it off at the end of the frame and lays it in win-rows ; or, if grain, it is deposited by said apron into a box with a sliding bottom, by which it is dropped in gavels ;—said frame being raised and lowered, so as to be adapted for the kind of cutting required, by pins inserted through posts of the frame into the shaft.’

“ The wheel above spoken of is in the form of a reel, having two heads, and vertical rounds, or slats, extending from one to the other ; on these rounds, or slats, the fingers are fixed, while the scythes are on the lower head. The claim is as follows :—

“ ‘ The invention claimed, and desired to be secured by letters patent, consists in the before described construction of the wheel for cutting grass, grain, and other articles, and depositing the same upon a revolving apron, which lays it in win-rows, or gavels ; in combination with the inclined boards and fingers, box with sliding bottom, and levers and spring for drawing it out and in, as herein set forth. And it is to be understood that the parts separately are not claimed, but only in combination ; and, in the wheel, the heads and vertical axle are not claimed at all.’

“ Most of the mowing machines which have been made have disappointed the hopes of their projectors,—the operation being one of no small difficulty. We are well convinced that the one before us will not steer clear of the objections which have been found to exist in others that have had their brief day, and then expired.” *Jour. Fran. Inst.* vol. xxiii. New Series, p. 242.

William Brittain and John Silvers, of New Hope, Pennsylvania, flax or hemp gathering, November 25, 1838. This machine is here

noticed because it is similar, in its general construction, to a machine for cutting and gathering flax, hemp, &c., for which Letters Patent were subsequently granted to Richard M. Cooch, July 16, 1841.—“ The claim under this patent is to ‘ a machine, which, as it is drawn forward, embraces the plants between a revolving drum and bands, by which they are pulled out of the ground and deposited on a suitable platform, as described.’ The platform which sustains the revolving drum runs upon wheels which bear upon the ground ; and the axle of one pair of these wheels is geared, by bevil wheels, to the axis of a drum which revolves horizontally. The plants pass in between this drum and a pointed arm, which projects forward ; they are there clasped between the drum and bands, which extend in part round it, and round guide pulleys, and are thus pulled out of the ground, and carried far enough round the drum to be deposited on the platform ; —the bands being led off from the drum by the guide pulleys at the required point.” *Jour. Fran. Inst.* vol. xxiv. New Series, p. 322.

Asa P. Trask and Davis Aldrich, of Ellington, New York, mowing machine, October 16, 1839.—“ The claim made is to the ‘ placing the two front wheels on which the mowing machine moves, within the wheel of scythes, as described ; and also the revolving rake for laying the grain in gavels, regulated in its action by the arrangement of the rods and wires, as described, in combination with the wheel of scythes.’

“ In the general construction of this machine, so far as the cutting by means of scythes arranged around the periphery of a wheel, revolving horizontally, near the ground, is concerned, it does not present any thing that is new : the claim is, therefore, confined to the details above pointed out, which may probably be productive of some advantage.” *Jour. Fran. Inst.* vol. xxvi. New Series, p. 389.

Seth Lamb, of New York, mowing machine, June 20, 1840.—“ Sickles are attached to the rim of a horizontal wheel in the front of the machine—they are curved in the usual way, are provided with teeth, and are so placed as to incline in the direction of the motion of the wheel. As the wheel revolves, the sickles pass between guides, or fingers, placed below and extending out in front and beyond the end of the sickles, and bows, or guards, which reach from the points

of the guides, or fingers (being attached to them) to some distance back of the point where the sickles are affixed to the rim of the wheel. On each side of the front of the machine there is a guide, inclining out, so that the grain, as it is cut, is gathered in, and made to pass over the sickle-wheel, within that part of its diameter where the gearing to drive it is placed. The guides, or fingers, may be made with a sharp edge, or with teeth like the sickle. The grain is deposited on a platform at the back of the sickle-wheel, and on a level with its top; and by the side of this platform there is another, somewhat elevated, on which the grain is placed when removed from the first, and there made into sheaves, whilst the machine is in motion.

“The claim is to the combination of the bows or guards with the guides or fingers, the sickles, and the guards at the sides of the front of the machine. Also the platform on which the grain is placed to be made into sheaves. And, finally, the ‘placing of the sickle-wheel and its appendages at the inner side of the machine, so as to permit the horse to travel by the side of the grain in front of the machine, and to allow the platform (on which the sheaves are made,) to extend by the side of it, for carrying the grain.’” *Jour. Fran. Inst.* vol. ii. Third Series, p. 129.

Jacob Hinds, of Hindsburg, New York, mowing, cutting grass under water, September 5, 1840.—“Two scythes are attached by their heels to a bar of iron, which forms a handle—the scythes diverge in nearly opposite directions, so that their points will be about six feet apart. The handle is held by a person at the stern of a boat, the scythes dragging on the bottom; and as the boat moves they cut the grass.

“Claim.—‘I do not claim to be the inventor of the scythe; but what I do claim is, the connecting of two scythes at their heels, and to a bar of iron, &c., for the purpose and in the manner described.’” *Jour. Fran. Inst.* vol. ii. Third Series, p. 335.

Alfred Churchill, of Geneva, Illinois, mowing, harvesting grain, March 16, 1841.—“This machine is intended for thrashing all kinds of grain when standing in the field, without cutting the straw.

“There are two chains, one on each side of the forward part of the machine; which chains pass over rollers, or pulleys, and to which four rods are attached at equal distances apart. Immediately back of

these chains and rods is placed the thrashing cylinder and concave, which are of the usual construction; and between the chains and rods, and the thrasher, there is a cap, provided with hooks, which slides up and down. As the machine is pushed forward, the rods on the chains catch the heads of grain and push them towards the thrasher; at the same time one of the rods on the chains catches the hooks on the cap, which is thus lifted up, the heads of grain are pushed under, the cap is then relieved, falls on to the grain, and holds it during the operation of thrashing.

“ Claim.—‘ What I claim as my invention, and desire to secure by letters patent, is the method, herein described, of gathering and thrashing grain at the same time, by means of the revolving rods, and oscillating or revolving cap, constituting the gatherer, in combination with the thrasher and concave,—the whole being constructed and operating substantially in the manner set forth.’ ” *Jour. Fran. Inst.* vol. iii. Third Series, p. 340.

Damon A. Church, of Friendship, New York, mowing, harvesting machines, cutting, thrashing, and winnowing grain, May 4, 1841.—

“ On the forward part of this machine there is a set of V-shaped cutters, with points that separate the heads of the grain from the straw; above these cutters there is a gathering wheel, with strips that reach from end to end, to catch the heads of the grain, as the gathering wheel revolves, and force them against the V-cutters, which separate them from the stocks. The heads of grain are delivered from the cutters on to an endless apron, which extends along behind the cutters until it arrives at a point where it meets two endless aprons, between which the grain is conducted up to a thrashing machine, of the usual construction. From the thrashing cylinder the grain and straw are discharged on to an endless apron of netting, with meshes sufficiently small to prevent the passing through them of the thrashed heads, but allowing the grain to fall upon another endless apron, which carries it back, until it falls down in rear of a fan wheel, by which the chaff and dirt are blown out, whilst the grain descends into a box. The cutters are each hung upon a joint pin at the heel, and are borne up against the gathering wheel by a spring.

“ The claim is to the ‘ manner of constructing the knives, or cut-

ters, so as to hang each of them upon a rod, or joint pin, whilst they are each sustained by a spring, as described; also, to the combination of the apron that receives the grain from the gathering wheel, with those that conduct it to the thrashing cylinder; and, finally, to the endless apron of network that receives the grain, &c., from the thrashing cylinder, with the one that conducts the grain to the fan."

Jour. Fran. Inst. vol. iv. Third Series, p. 35.

Richard M. Cooch, of Lambertsville, New Jersey, mowing, cutting, and gathering flax, hemp, &c., July 16, 1841.—"This machine is, in its general construction, like that for which a patent was granted to William Brittain and John Silvers, on the 25th of November, 1838, and noticed in this Journal, vol. xxiv. of the second series, page 323, to which the reader is referred for a general description of its construction: the improved machine differs essentially from the former in its being made to cut the flax, or hemp, close to the ground, instead of being a 'machine for pulling flax and hemp.' The flax, or hemp, is caught between a horizontal drum and a system of endless belts, there being a projecting arm or gathering piece, which conducts it to the drum; and whilst it is held and carried forward by the drum and belts, it is cut off, close to the ground, by a revolving knife, which is operated by the system of belts employed to catch and hold the hemp, &c.

"Claim.—'What I claim as my invention, and desire to secure by letters patent, is the combining of the revolving knife with the drum, the gathering piece, and the endless bands, as herein described, so as to convert the said machine from one for pulling flax and hemp, into one for cutting and delivering the same,—the whole being constructed and operating substantially as set forth.'"
Jour. Fran. Inst. vol. iv. Third Series, p. 192.

Jonathan Read, of New York, reaping machine, March 12, 1842.—
"Claim.—'I claim, and desire to secure by letters patent as my invention, the construction of the vibrating cutters with serrated edges—whether said cutters be connected together so as to form a vibrating bar, or be placed separately on a bar of this kind, as set forth—in combination with the stationary teeth or blades serrated in similar manner, and arranged below the former, as described. I also claim the mode of constructing the rake and combining it with the bed of

the machine, by forming it with pointed fingers on the ends of the arms, and arranging the fingers in spaces formed in the bed, as set forth. I also claim the manner of discharging the grain from the bed by means of said rake, and in the manner already described.' " *Jour. Fran. Inst.* vol. xii. Third Series, p. 117.

C. Brown and F. S. Crans, of Barton, New York, mowing, cutting, and cleaning grain, April 6, 1842.—The patent is granted for an improvement in the method of discharging the grain from the teeth of the cutting part of the machine, which consists of a wheel, with small scythes projecting from the wheel, with rake-teeth ranged above each scythe to hold on to the grain; and the improvement consists in the peculiar arrangement of sets of teeth attached to the ends of levers, each set playing between each rake over the scythes; and these are so operated by a cam and segment, that as each rake passes by the place of deposit, the clearers are moved out from the periphery of the wheel to the end of the rake-teeth to discharge the grain, and then back for a repetition of the operation.

" Claim.—' We do not claim as our invention merely discharging the grain from the teeth or rake by means of other fingers passing between them, as this has been done before by stationary fingers; but what we do claim as our invention, and desire to secure by letters patent, is the mode of discharging the grain from the rake by means of the moveable discharger, operated by the cam and segment as herein described.' " *Jour. Fran. Inst.* vol. xii. Third Series, p. 390.

Jesse Reeder, of Alton, Illinois, grain cutters, January 20, 1843. The following notice of the claim made by the patentee is extracted from the Patent Office Report for 1843, page 406:—

" Having thus fully described the nature of my improvement in the apparatus for harvesting small grain, what I claim therein as new, and desire to secure by letters patent, is the combining of the system of fingers c, c, with the revolving and the stationary cutters used for cutting the heads of the grain from the straw. The said combined apparatus being constructed and operating substantially as herein fully set forth. I do not claim the use of stationary horizontal fingers for conducting the heads of grain to the cutters, these having been previously used; but limit my claim to such as are hung by joint pins, in the manner set forth."

Jacob Peck, of Oakland, Pennsylvania, corn and cane cutters, August 28, 1844.—“ What I claim as my invention, and desire to secure by patent, is the *knife* designated by the letter *c*, in the drawing, in combination with the *revolving cross-arms* (letters *f, f*,) driven by the *bevilled cog-wheels* (letters *c, c*,) *arranged and constructed as described*; and also the arrangement of the *knife* and *revolving cross-arms in combination with the ear* (*a, a*,) and guiding rod (*h, h*,) and all as described and seen by the drawing and letters referred to as part of, in these specifications, the accompanying drawings, references, and explanations.

“ In testimony that the above are my specifications, I hereunto set my hand.” *Patent Office Report*, 1844, p. 667.

George Esterly, of Heart Prairie, Wisconsin, mowing, harvesting machines, October 22, 1844.—“ This is for an improvement in that kind of machines by which the heads of the plants only are cut off, and the straw or stocks permitted to remain.

“ The box which receives the grain is supported on wheels, and is provided with a permanent knife in front, and a rotating reel with beaters which carry the heads of grain up against the permanent knife to cut them off. This reel is set in motion by a belt, at each end, that passes around a wheel on the carrying wheels of the machine,— it being deemed important to have the reel of such length as to require a belt at each end; and as this would occasion difficulty in turning the machine, the reel is made in two parts, the shaft of one half being tubular to receive the solid shaft of the other. The axle-tree of the supporting wheels works in adjustable boxes, connected with the body of the machine, so as to enable the operator to adjust the machine to the average height of the grain to be harvested; and, in addition to this arrangement, the body is connected with the horse-frame at the axle-tree; and by means of a lever, connecting the two, the attendant can adjust the cutter to the varying height of the grain in the field.

“ Claim.—‘ What I claim as my invention, and desire to secure by letters patent, is the mode of adapting the machine to different and varying heights of grain, by the combination of the adjustable boxes which connect the axle of the wheels with the receiver to which the cutters and reel are attached, in combination with the lever that connects the receiver with the horse-frame, as described.

“ ‘ I also claim as my invention, and desire to secure by letters patent, making the reel in two independent parts, the shaft of one passing through the shaft of the other, so that they can turn with velocities corresponding with the velocities of the main wheels, in turning curves of various degrees, as described, and removing the strain from the axle of the reel, cutters, and propelling gear, as herein set forth.’ ” *Jour. Fran. Inst.* vol. ix. Third Series, p. 385.

William F. Ketchum, of Buffalo, New York, mowing, reaping machines, November 18, 1844.—“ In this machine, the grain is cut by means of vibrating cutters, projecting somewhat in the manner of saw teeth from one edge of a plate. The cog gearing, which forms the connexion between this vibrating plate and the supporting wheels of the carriage, to which the whole mechanism is attached, is placed within the supporting wheels, that have cogs on their inner peripheries, and are cased in to protect the mechanism.

“ For the purpose of bending in the heads of grain and holding them whilst being cut, there is an endless apron, which passes over rollers at a proper height above the cutters.

“ Claim.—‘ What I claim as my invention, is the combination of the driving wheels with the cutters, in the manner described, by forming internal gear on the wheels, and enclosing all the driving gear inside of them by the construction and arrangement above set forth.

“ ‘ I also claim the employment of an apron in combination with the cutters, for turning in the tops of the grain, as herein described.’ ” *Jour. Fran. Inst.* vol. x. Third Series, p. 18.

Cyrus H. Mc Cormick, of Rockbridge, Virginia, mowing, reaping machine, January 31, 1845.—“ I claim, 1st, the curved (or angled downward, for the purpose described) bearer, for supporting the blade, in the manner described.

“ 2nd. I claim the reversed angle of the teeth of the blade in the manner described.

“ 3rd. I claim the arrangement and construction of the fingers, (or teeth for supporting the grain,) so as to form the angular spaces in front of the blade, *a*, *s*, and for the purpose described.

“ 4th. I claim the combination of the bow *L*, and dividing iron *M*, for separating the wheat, in the way described.

" 5th. I claim setting the lower end of the reel post *r*, behind the blade, curving it at *r*, and leaning it forward at top, thereby favoring the cutting and enabling me to brace it at top by the front brace *s*, as described, which I claim in combination with the post." *Patent Office Report*, 1845, p. 1255.

" This is for improvements on that kind of machines in which the grain is cut by the serrated edge of a straight and vibrating cutter, operated by a crank, the grain being sustained by fingers. The blade is serrated like a sickle, except that the angle of the teeth is reversed for every alternate tooth, and the supporters of the blade are secured by screws to the front part of the platform, and bent down and then up, to give a free escape to straw which may enter the machine. — The fingers for supporting the grain are spear-formed and the angle of the edge begins to run in forward of the edge of the cutting blade, so as to form an angular shear to ensure the support of the grain in the act of cutting. The other improvements are fully pointed out in the following claim.

" Claim.—' I claim 1st the curved (or angled downward for the purpose described) bearer, for supporting the blade in the manner described.

" ' I claim the arrangement and construction of the fingers or teeth for supporting the grain so as to form the angular spaces in front of the blade, as and for the purpose described.

" ' I claim setting the lower end of the reel post behind the blade, curving it and leaning it forward at the top, thereby favoring the cutting and enabling me to brace it at the top by the front brace, as described, which I claim in combination with the post.' " *Jour. Fran. Inst.* vol. x. Third Series, p. 247.

Erastus C. West, of Bradford, Vermont, harvesting machine, June 25, 1845.—" The scythes are attached to arms at the lower end of a vertical shaft, and to the same shaft are attached the fingers of the cradle, which in their rotation pass between the fingers of a vibrating hand, which catch the straw, &c., and carry it to the apron, which conducts it to the thrasher. The hand is vibrated by a lever, receiving motion from a cam groove at the upper end of the scythe shaft.

" Claim.—' What I claim as my invention, and which I desire to

secure by letters patent, is the before described arrangement of the vibrating hand, in combination with the revolving cradles, operated by the lever and eccentric grooved wheel or plate at the head of the axle of the cradle." *Jour. Fran. Inst.* vol. xi. Third Series, p. 329.

Ferdinand Woodward, of Upper Freehold, New Jersey, mowing, reaping machine, September 30, 1845.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a sheaf-box with the platform into which the grain is thrown before being deposited upon the ground from the platform." *Patent Office Report*, 1845, p. 1336.

William F. Ketchum, of Buffalo, New York, cutting grain, March 7, 1846.—"Claim.—'What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the rake-teeth, the same consisting of two plates of unequal length, and each set being made separate, and not a whole plate, as heretofore. I claim, further, the arrangement of having the operating parts, as the driving wheels, under the platform on which the cut grain falls, as illustrated in the specification and drawings.

" 'I claim, in particular, using one or more revolving sharp-edged shafts, for the purpose to carry the cut grain from the knife-blade to the platform, in the manner set forth.' " *Jour. Fran. Inst.* vol. xiii. Third Series, p. 238.

Jeremiah Darling, of Adrian, Michigan, thrashing and reaping grain, March 7, 1846.—"Claim.—'What I claim as my invention, and desire to secure by letters patent, is the carrying or gathering platforms, formed of slats with pointed teeth thereon, and moved substantially as described, with the cutting and thrashing apparatus, as set forth.

" 'I also claim the mode of steering by pivot wheels, in combination with the reaping apparatus, as described.' " *Jour. Fran. Inst.* vol. xiii. Third Series, p. 242.

Clinton Foster, of Laporte, Indiana, cutting and raking, April 18, 1846.—"In this machine the grain is cut by a set of cutters, projecting from the edge of a vibrating bar, and acting on the grain between a series of fingers; and the improvement patented consists in the peculiar manner of constructing the rake by which the grain is delivered

from the platform on which it falls when cut. The platform is made with a series of grooves, in which the points of the rake slide, as they are operated by the vibration of a lever that receives motion from tappets on the driving wheel.

“Claim.—‘What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the rake, and its connexion with the floor of said machine, as herein described.’” *Jour. Fran. Inst.* vol. xiii. Third Series, p. 319.

Edwin Owen, of Byron, Indiana, cutting cane, brush, &c., May 30, 1846.—“To one side of the forward part of a carriage are attached two knives, with their edges coming together at the heel, which is placed higher than their points, to make an oblique cut on the stocks, the edges having a corresponding inclination.

“Claim.—‘Having thus fully described my improvements and their operation, I wish it to be understood that I do not claim the diverging knives, as they have been used; nor do I claim attaching oblique knives to a carriage, for the same reason; but what I do claim as my invention, and desire to secure by letters patent, is the diverging knives, fastened to a carriage in the manner described, with their points depressed and their edges elevated, substantially in the manner and for the purpose herein set forth.’” *Jour. Fran. Inst.* vol. xiii. Third Series, p. 403.

Alexander M. Wilson, of New York, cutting grass and grain, September 3, 1846.—“The patentee says.—‘My improvements consist, first, in making the cutting edges of the cutters of a more gradual curve, and rounding off the heel, so as to continue cutting as the machine approaches the uncut grain, or grass, to avoid throwing too much work on the heel part of the cutters, and, at the same time, to bring into action a greater extent of cutting surface for a given size of wheel than could possibly be attained by the previous mode. Secondly, the cutting and gathering wheel has its bearings in the main frame of the machine; and the horses are harnessed to a frame which is jointed to the forward part of the main frame, but back of the centre of the cutting wheel, and extending diagonally to the side, so that the horses are in the swath previously cut, and pass over the irregularities of the surface, leaving the cutters free to follow the undulating

surface. Thirdly, I connect the drum of the cutting and gathering wheel to its shaft by means of curved or dished arms, and bend the runners up within the drum, to receive guide-wheels, to adapt the cutters to the inequalities of the surface of the ground, instead of relying entirely on the friction of the runners. And, fourthly, I grind the upper bevilled edges of the cutters by means of a horizontal rotating grinder, the under surface of which is bevilled to the inclination of the bevilled faces of the cutters, and combine this with a permanent grinder, over which the cutters pass, to remove the wire edges produced by the rotating grinder.'

" Claim.—' 1st. What I claim as my invention, and desire to secure by letters patent, is making the heel of the cutters rounded, when a number of cutters are combined together on a wheel, to cut grass, or grain, by the rotation and forward movement of the machine, as herein described.

" ' 2d. I claim jointing the horse-frame to the forward part of the main frame, but back of the shaft of the cutting wheel, so as to have the horses placed forward and to the side of the cutters, in combination with a wheel of cutters for cutting grain, or grass, so that the cutters may follow the undulations of the ground, independent of, and not affected by, the up-and-down movement of the horse, as herein described.

" ' 3d. I claim the employment of the guide-wheels, in combination with the cutting and gathering wheel, connected with its shaft by means of curved or dished arms, as herein described.

" ' 4th. I claim, in combination with the curved cutters attached to and forming the cutting wheel, the rotating grinding wheel, for grinding the upper bevilled face of the cutters, as described; and finally, I claim, in combination with this, the grinder for grinding the under surface of the cutters, as described.' " *Jour. Fran. Inst.* vol. xv, Third Series, p. 25.

Isaac Lard, of Ashley, Mobile, cutting grass, November 20, 1846.

—" Claim.—' What I claim as my invention, and desire to secure by letters patent, is—

" ' 1st. The arrangement of the revolving rake for taking the grass from the scythes as fast as cut, and depositing it in the rear, in com-

bination with the revolving scythes, arranged and operating in the manner and for the purpose above set forth.

“ ‘ 2d. I claim the arrangement of the curved bar for bearing off the heads of the grass, to enable the cutters to cut the grass more effectually, in combination with the frame, as set forth.’ ” *Jour. Fran. Inst.* vol. xv. Third Series, p. 163.

Andrew J. Cook, of Delphi, Indiana, cutting grass, November 20, 1846.—“ The patentee says,—‘ The nature of my invention consists in the construction and movement of a rake for taking the grain or straw off the platform of the cutters at regular intervals, and in the manner of steering the machine.’ ”

“ Claim.—‘ What I claim as my invention, and desire to secure by letters patent, is the revolving rake, constructed and combined with the cutting apparatus in the manner described.

“ ‘ I also claim the arrangement of steering the machine as herein fully described, in combination with the grain-cutting apparatus, as herein fully set forth.’ ” *Jour. Fran. Inst.* vol. xv. Third Series, p. 164.

Clinton Foster, of Laporte, Indiana, cutting and thrashing grain, January 1, 1847.—“ What I claim as my invention, and desire to secure by letters patent, is the combination of the cutting and thrashing apparatus, herein described, in one harvesting machine, is connecting the knives separately with the respective rods *l*, and the eccentrics *m*, and their arrangement and combination with the guides *g*, and the cutting plate *i*, being a spur and balance wheel combined.” *Patent Office Report*, 1847, p. 855.

Damon A. Church, and Lovett H. Obert, of Friendship, New York, and Weston W. Willoughby, and O. F. Willoughby, of Chicago, Illinois, harvesting machine, February 13, 1847.—“ Having thus fully described the nature of our improvement in the within described harvesting machine, what we claim as new therein, and desire to secure by letters patent, is the manner herein set forth of constructing the separator, so that it shall consist of separate combs, turning on pivots, in endless chains, and operating in the manner herein made known.” *Patent Office Report*, 1847, p. 869.

John Dunlap, of Walworth County, Wisconsin, harvesting ma-

chine, June 26, 1847.—“ What I claim as my invention, and desire to secure by letters patent, is the swinging brush, as represented in the annexed drawings, figures 1, 2, and 3, and herein described, swinging on the shaft of the reels on the inside of the reel, as heretofore described, and in combination with the stationary brush, for the purpose as herein set forth and described.” *Patent Office Report*, 1847. p. 923.

William F. Ketchum, of Buffalo, New York, reaping machines, July 10, 1847.—“ The patentee says,—‘ The nature of my invention consists in an endless chain cutter, for cutting grain and grass, and the application of it in such a way as will cause it to run around pulleys, with the back of the cutter against them—(the pulleys are fixed on the rack piece of proper length for the width of the swath to be cut)—with the cutter passing round the pulleys, the cutter being covered all but the edge, which comes in contact with the grain or grass.’

“ Claim.—‘ What I claim as my invention, and desire to secure by letters patent, is the endless chain cutter, in combination with the pulleys and rack teeth, for cutting grain and grass, as described. I also claim the crooked arm or coupling piece, in connexion and combination with the rack piece and frame, as above set forth, for the purposes stated.’” *Jour. Fran. Inst.* vol. xvi. Third Series, p. 229.

Obed Hussey, of Baltimore, Maryland, reaping machines, August 7, 1847.—“ The patentee says,—‘ The improvement for which a patent is now asked, is fastening the upper piece of the guard to the lower piece only at the point, leaving the back end unconnected; consequently the space between the lower and upper pieces of the guard, through which the blades vibrate, is open behind, so that the grass, &c., which is forced in, by the action of the blades, now passes freely out through the opening; which opening, when used in combination with vibrating blades, constitutes a claim in this improvement. My improvement extends also to the prevention of the accumulation of grass, &c., under the blades.’

“ Claim.—‘ I claim the opening above the blades, in combination with vibrating blades. I also claim the particular application of the flush edge at the fork of the blades, for the purpose described.” *Jour. Fran. Inst.* vol. xvi. Third Series, p. 306.

“ Martin Butts and Laurette Church (administrators of the estate of Damon A. Church, deceased,) and L. H. Obert, of Friendship, New York, and W. W. Willoughby and O. F. Willoughby, of Chicago, Illinois, harvesting machine, August 7, 1847.—“ The patentees say,—‘ It has been found that the knives, although made and joined together with the utmost care, eventually become open in the joint, lose their interior cutting angle, and admit the fibres of vegetable matter between them. This difficulty is obviated by constructing the knives so as to be solid in that part.’

“ Claim.—‘ What we claim as new, and desire to secure by letters patent, is the forming such knives solid at their inner angles, as described.’ ” *Jour. Fran. Inst.* vol. xvi. Third Series, p. 307.

Cyrus H. Mc. Cormick, of Steele's Tavern, Virginia, reaping machines, October 23, 1847.—“ What I claim as my invention, and desire to secure by letters patent, as improvements on the reaping machines secured to me by letters patent, bearing date the 21st of June, 1834, and the 31st of January, 1845, is, placing the gearing and crank forward of the driving wheel, for protection from dirt, &c., and thus carrying the driving wheel further back than heretofore, and sufficiently so to balance the rear part of the frame and the raker thereon, when this position of the parts is combined with the sickle, back of the axis of motion of the driving wheel, by means of the vibrating lever, substantially as herein described.

“ And I also claim as my invention, the arrangement of the seat of the raker over the end of the finger piece, which projects beyond the range of fingers, and just back of the driving wheel, as described, in combination with, and placed at the end of, the reel; whereby the raker can sit with his back towards the team, and thus have free access to the cut grain laid on the platform and back of the reel, and rake it from thence on to the ground by a natural sweep of his body, and lay it in a range at right angles with the swarth, as described, thereby avoiding unevenness and scattering in the discharge of the wheat, as well as accomplishing the same with a great saving of labour.” *Patent Office Report*, 1847, p. 971.

Francis S. Pease, of Buffalo, New York, harvesting machines, November 14, 1848.—“ I do not claim to be the inventor of the turning

alternating rake and slotted double platform ; but what I do claim is the combination of the levers B, J, K, and A''', connecting rod L, and spring F, figures 1 and 4, with the double platform and rake D''', figure 1, for the purpose of alternating and turning the latter, as herein described.

" I do not claim to be the inventor of a tight case for the back of the blade to run in, nor of slotted teeth to protect its edge ; but what I do claim, is making a toothed blade case in uniform sections, (c, fig. 2,) each section having a tooth cast in one piece with it, the whole being attached to the rack bar, (a, fig. 2,) by screws or otherwise, in such a manner that if the tooth or case of any section should get broken, it may readily be replaced by an extra one, cast from the same pattern and kept on hand for that purpose ; the rack thus made being equally efficient to protect the stock from dirt and obstructions with the solid case, and capable of being more easily and cheaply repaired.

" I also claim the manner in which the position of the point of draught is changed, by means of the slides (b, and c, figs. 3, and 4,) and clamp screws (D', and e, fig. 3,) as herein set forth." *Patent Office Report*, 1848, p. 1090.

William Boone, of New Hope, Mobile, grass cutting machines, November 21, 1848.—" I do not claim to be the original inventor of a mowing machine, having scythes attached to a vertical pendant rotary axle, operated by cast and cog-wheels by the draught of a horse or other animal ; but what I do claim as my invention, and desire to secure by letters patent, is—

" 1st. The combination and arrangement of the hinged scythes H, and radial boxes M, as constructed and operated with the vertical pendant axle G, and gearing A, D, E, F, to propel the same, as described ; said scythes being so constructed and arranged as to form a circular cutting edge, whilst each segment of the cutter forms by itself a hinged segmental scythe that can be raised or disengaged from the radial box at pleasure, with very little inconvenience, for grinding the edge or for any other purpose, and be again restored to its place ; the cutting being performed on the convex edge of the scythe instead of the concave edge, as with ordinary scythes.

" 2d. I likewise claim the manner of sustaining and supporting

the pendant revolving axle, by means of the extended cap of the frame, in combination with the extended axle-tree, as described." *Patent Office Report*, 1848, p. 1092.

Uriah H. Goble, and Alexander Stuart, of Urbana, Ohio, harvesters, November 21, 1848.—“What we claim as our invention, and desire to secure by letters patent, is—

“1st. The combination and arrangement by which we cause the rotating rake *h*, to pass horizontally across the platform *q*,—to wit, securing the rake to the shaft *g*, in such a manner that it can slide freely to and from the same, placing rollers *m m*, upon the projecting ends of the bar *r*, (parallel with the rake-head) operating with the horizontal ways *n*, secured to the inner sides of the vertical ends *o o*, of the platform *q*, substantially as herein set forth.

“2nd. We also claim the imparting an unequal motion to the rake as it revolves, for the purpose herein set forth, by means of the eccentric pinion *n*, matching with the elliptical toothed wheel *e*, substantially as herein set forth.

“3d. We also claim the imparting to the rotating rake a horizontal movement from the front to the rear edge of the platform, combined with a gradually diminishing rate of speed, substantially in the manner and for the purpose herein set forth.” *Patent Office Report*, 1848, p. 1093.

Daniel Cushing, of Aurora, Illinois, harvesting machines, November 21, 1848.—“I do not claim to be the first inventor of a reaping machine drawn by horses, having vibrating cutters, actuated by gearing connected with a main supporting and driving wheel, and having a revolving rake and platform upon which the grain is deposited, as this is an old invention; but what I do claim as my invention and improvement, and desire to secure by letters patent, is—

“1st. Making the vibrating cutters *r*, sickle-edged, moved in the manner and for the purpose set forth.

“2nd. I claim the manner of combining and arranging the double cranks *a*, *e*, and axles *o*, *q*, of the rakes, so as to cause them to turn together, and at the same time to turn the two endless rakes *l*, *m*, *n*, and *s*, *r*, *u*, as described.

“3d. I claim the before described particular arrangement of the

transverse endless revolving rakes *l, m, n*, in combination with rake *r, r, r*, for delivering the cut grain upon the platform *r*, as described." *Patent Office Report*, 1848, p. 1093.

Oliver Barr, of Aurora, Illinois, harvesting machines, January 16, 1849.—"1st. I claim the form of the *fixed sickles t*, with the *curved edges*, in combination with the *triangular sickles q*, attached to the *vibrating bar p*, and operated substantially as herein above specified.

"2nd. I claim the *combination and arrangement* of the guide rail *u*, with the *reel heads b*, the *chain bands a*, the *revolving rake g*, and the *inclined platform s*, formed, applied, and used substantially as above set forth.

"3rd. I also claim the combination of the *trap doors or folding platform w*, for the purpose of forming and dropping the grain in a bundle, with the *cam-blocks, inclined wedge*, levers and cord, or other similar devices, arranged and operated in substantially the same manner for attaining the same object." *Patent Office Report*, 1849, p. 155.

Jonathan Haines, of Union Grove, Illinois, harvesting machines, March 27, 1849.—"Having thus described the construction and operation of my improved harvester, what I claim therein as new, and desire to secure by letters patent, is suspending the frame which carries the conveyer, reel, and cutter upon the axles of the wheels *A, A'*, when the frame thus suspended is hinged to the tongue, and rendered capable of being turned upon its bearings by means of a lever, for the purpose of elevating and depressing the cutter, as herein set forth." *Patent Office Report*, 1849, p. 209.

James L. Fountain and Henry K. Fountain, of Rockford, Illinois, harvesters, May 15, 1849.—"Having thus described the construction and operation of our improved harvesting machine, what we claim therein as new, and desire to secure by letters patent, is giving to a vibrating blade a compound transverse and horizontal stroke or cut, by combining it with jointed vibrating levers, (*m*,) or other similar device, capable of producing the same movement, when the same is combined with stationary teeth (*h*,) or a reel (*b*,) substantially in the manner and for the purpose herein set forth." *Patent Office Report*, 1849, p. 258.

John Hinton, Monroe County, Virginia, harvesters of clover-heads, May 22, 1849.—“ What I claim as my invention, and desire to secure by letters patent, is—

“ 1st. The combination and arrangement of the transverse pendant finger bar *i*, the mortised right angled plates *f*, adjustive slide bars *g*, and knife or cutter *k*, with the revolving axle-tree of spring conveyor bars *p*, arranged and operating in the manner described, by which the heads of clover are severed from the stems or stalks, and conveyed to a receiver.

“ 2nd. I also claim the combination of the right angled rods *l*, fingers *j*, and pendant bar *i*, with the transverse timber *m*, for adjusting the knife and fingers longitudinally and vertically in connexion with the spring conveyor bars *p*, as described and represented.” *Patent Office Report*, 1849, p. 263.

Alfred James Purviance, of Updegraffs, Ohio, harvesting machines, May 22, 1849.—“ Having thus fully described the nature and construction of my improvements, what I claim therein as new, and desire to secure by letters patent, is constructing the platform separate from the other framework, as described, so that it can be readily put together or removed and the mower attached, as herein fully described and made known.” *Patent Office Report*, 1849, p. 264.

Nelson Platt, of Ottawa, Illinois, harvesters, June 12, 1849.—“ What I claim as my invention, and desire to secure by letters patent, is the combination of a series of removeable cutters with the links of an endless revolving chain, which carries them successively into contact with the grass or grain to be cut, substantially as herein described, whether the cutters be contiguous or placed at intervals upon the chain.

“ I also claim making one end of each cutter sharp, in order that, by pressing against the adjacent end of the next cutter, straw, grass, or other intervening obstructions may be cut in two and allowed to pass out,—the cutters thus freeing themselves from obstructions which might otherwise choke or break them.

“ I also claim placing the bundles or sheaves of grain at right angles to the path of the machine, by means of a second rake (*n*), combined with the first, substantially as herein set forth.

" I also claim moving or turning the first rake by cords, chains, or belts, arranged and operated as described, or in any other substantially similar manner.

" I also claim vibrating the second rake (*h*,) and turning its teeth as herein set forth, whether the devices employed to effect these movements be such as described, or others equivalent thereto.

" I also claim changing the frequency of the alternations of the rakes by means of the cones of wheels (3, 4, 5,) and pinions (3', 4', 5',) or other equivalent device for the purpose of varying the size of the sheaves, as herein set forth." *Patent Office Report*, 1849, p. 272.

Jacob J. Mann and Henry F. Mann, of Clinton, Indiana, grain carriers for harvesting machines, June 19, 1849.—" Having thus fully described our improvements and the mode of operation, what we claim therein as new, and for which we desire to secure letters patent, is the employment, in combination, of a double series of endless bands *e*, *e*, and *f*, *f*, constructed and arranged substantially in the manner and for the purpose set forth, by which the grain is raked and carried over one side of the machine, as described.

" And, lastly, we claim the receiver *m*, for collecting the grain into bundles, and discharging it from the machine at once, in the manner herein above made known." *Patent Office Report*, 1849, p. 277.

Pells Manny, of Waddams Grove, Illinois, harvesters, June 26, 1849.—" What I claim as my invention, and desire to secure by letters patent, is arranging a series of inclined knives (*b*,) diagonally across the spaces between the fingers (*a*,) the front end of the cutting edge of one knife projecting beyond the rear end of the cutting edge of the one next succeeding it, substantially as herein described, and acting in combination with revolving spiral cutters (*e*,)

" I likewise claim attaching the pole (to whose hinder extremity the team is attached) to the hinder part of the carriage by a pivot (*n*,) in combination with the ropes (*o*, *o'*,) and windlass (*o'*,) by which it is turned; by which arrangement the machine can be turned in a small space and without inconveniencing the team." *Patent Office Report*, 1849, p. 282.

Eliakim B. Forbush, of Buffalo, New York, form of teeth in har-

vesting machines, November 27, 1849.—“ What I claim as my invention, and desire to secure by letters patent, is an *open triangular tooth or triangular hollow tooth* for cutting grass and grain, with its results, as herein described. *Patent Office Report*, 1849, p. 364.

Samuel Krauser, of Reading, Pennsylvania, clover harvesters, December 18, 1849.—“ What I claim in the foregoing as my invention, and desire to secure by letters patent, is maintaining the series of teeth at nearly the same angle with the ground at all heights to which they may be adjusted therefrom, in the manner herein set forth and represented in fig. 1.

“ I also claim forming the fingers with a depression on their upper side above the knife, substantially in the manner and for the purpose herein set forth.” *Patent Office Report*, 1849, p. 375.

Homer Adkins, of Round Prairie, Illinois, mowing machines, January 15, 1850.—“ Having thus explained my invention, I claim the master wheel A, constructed with cogs on its face, in combination with the rocking shaft R, constructed with two knobs or projections n^1 , n^2 , on it, to give a rocking motion to the said shaft, in the manner substantially as described.” *Patent Office Report*, 1850, p. 105.

John E. Heath, of Warren, Ohio, harvesting machines, January 15, 1850.—“ What I claim in the foregoing as my invention, and desire to secure by letters patent, is the method of cleansing the cutters, by giving them at suitable intervals a larger vibration than ordinary, substantially in the manner herein set forth—thus detaching the dirt and gum which accumulates upon them.” *Patent Office Report*, 1850, p. 106.

Hazard Knowles, of Washington, District of Columbia, and Henry C. Bevington, of Holmes, Ohio, cutters and rakes of a grain and grass harvester, July 2, 1850.—“ What we claim as new, and desire to have secured to us by letters patent, is—

“ 1st. Making the pointed cutters n , concave on the faces towards each other, in the manner and for the purpose set forth, by which the cutters are rendered self-sharpening, and bending the upper plate over the back of the lower or sliding cutter plate, and bringing the notched or turned edge against the lower plate, in the manner and for the purpose described.

" 2nd. The arrangement of the stationary *cyma reversa* fingers *p*, in combination with the vibrating hook teeth or claws, (*o*,) bands *c*, and the appendages for operating the same, by which the grain is collected into sheaves or gavels, before being discharged upon the ground.

" 3rd. The combination of the hook teeth or claws *o*, rock-shaft *m*, bent arm (*n*,) lever (*s*,) spring (*j*,) and revolving arm *l*, for arresting the grain whilst removing the gavel or sheaf from the *cyma reversa* fingers *p*, on to the ground, as described.

" We likewise claim the combination of the pinion *h*, perch *p*, and axle *f*, the former working into the segment on the front axle-tree, for steering the forward part of the frame and cutters." *Patent Office Report*, 1850, p. 202.

Jacob Pierson, of Wilmington, Delaware, arrangement of cutters in a grain and grass harvester, July 2, 1850.—" Having thus fully described the nature of my improvements in mowing and reaping machines, what I claim therein as new and original, and desire to secure by letters patent, is the arrangement, substantially as herein described and represented, of cutters, bolted to an endless belt *s*, revolving in a vertical orbit, and moving on a rail *m*, guarded and disposed after the manner described." *Patent Office Report*, 1850, p. 203.

Ebenezer Danford, of Geneva, Illinois, grain harvesters, September 17, 1850.—" What I claim as my invention, and desire to secure by letters patent, is the application to a reaping and mowing machine, of two sickles, working together in opposite directions, as set forth in the above specification and accompanying drawings, so as to throw the weight of the moving parts upon opposite sides of the centre of the crank or bit, for the purposes set forth." *Patent Office Report*, 1850, p. 237.

Stephen Bowerman, of Detroit, Michigan, cotton stalk harvesters, October 1, 1850.—" What I claim as my invention, and desire to secure by letters patent, is the combination of two saw-teeth wheels with the frame, and supported thereby, and the triangular pieces of iron for disengaging the stalks in the manner herein set forth." *Patent Office Report*, 1850, p. 243.

John J. Herndon, of Bonneetsville, South Carolina, rice harvesters, October 1, 1850.—“What I claim as my invention, and for which I desire to secure letters patent, is the application of the vertical blade *r*, and wing, attached to either or both sides of a beam *A*, and their combination with each other, and the other parts of this machine running by hand or horse power.” *Patent Office Report*, 1850, p. 244.

George Hart, of Dillsborough, Indiana, mounting the cutters of a mowing machine, October 8, 1850.—“What I claim therein as new, and desire to secure by letters patent, is the method of constructing a revolving grass or grain cutter, so as to adapt itself to the varying surface of the ground, by means of hanging it by a universal joint on the end of a shaft, adjustable vertically, substantially as herein described.” *Patent Office Report*, 1850, p. 246.

Edmund Quincy, of Lacon, Illinois, grain and maize harvesters, October 8, 1850.—“What I claim as my invention, and desire to secure by letters patent, is the use of the revolving shaft *D*, in combination with a system of fingers, teeth, or knives, arranged on the shaft, as described, and for the purpose herein set forth, not confining myself to any particular size, shape, or curvature.” *Patent Office Report*, 1850, p. 247.

William Baily Coates, of Big Lick, Virginia, hemp harvesters, October 15, 1850.—“What I claim as my invention, and desire to secure by letters patent, is—

“1st. The box on the right, marked *Q*, which is a constant oil retainer.

“2nd. The combined sides *x*, *x*, and spring bottom *R*, *R*, for catching and laying the hemp, &c.

“3rd. I claim casting (or securing in any firm manner,) choppers on a rock-shaft *N*, with the edges chisel-shaped, and set so as to strike obliquely against the top and right edges of the teeth *P*, where the part *N*, moves by a lateral and semi-rotary motion. In procuring this combined motion, I employ a male and female screw thread, as already fully described, in the preceding part of these papers. I do not desire to be understood as confining myself to the screw in getting this motion in *N*, but will employ any other method most suitable to produce the desired result, and which shall be substantially the same.” *Patent Office Report*, 1850, p. 251.

William Watson, of Chicago, Illinois, maize harvester, October 15, 1850.—“ I wish it to be understood, that I do not limit myself merely to the various parts herein described, when combined together in a single machine, as some of these parts may be used without the others ; neither do I limit myself to the precise combination of parts described in this specification, as portions of one machine may be used in connection with portions of the others, thus constituting new machines, operating upon a common principle ; but what I claim as my invention, and desire to secure by letters patent, is the method, substantially as herein described, of separating the ears of Indian corn from the standing stalks on which they grow.

“ I also claim, in combination with the gathering forks, apparatus for husking and shelling the corn, substantially as herein set forth, whereby the gathering, husking, and shelling of corn, are performed at a single operation.” *Patent Office Report*, 1850, p. 252.

Edward Neely, of Savannah, Mobile, grass harvesters, January 7, 1851.—“ Having thus fully described my invention, what I claim therein as new, and desire to secure by letters patent, is the manner, herein described, of suspending the cutting ring *h*, from the wheel *f*, by means of straps, or other yielding material, for the purpose herein described.

I also claim the combination of the cutters *i*, *i*, *i*, &c., bevelled cutter ring *h*, and straps *g*, *g*, &c., for the purpose of raising the cutter ring over any obstruction coming against the edge of the knife, as herein described.

“ I also claim the manner of arranging the guide-board *m*, standard *n*, arm *o*, and strap *r*, secured as described, for the purpose of guiding the machine, and allowing the parts to yield to a sudden stopping of the machine, or to irregularities in the ground, for the purpose and in the manner herein described.” *Patent Office Report*, 1851, p. 112.

Sidney S. Hurlbut, of Racine, Wisconsin, grain harvesters, February 4, 1851.—“ Having thus described my improved reaping machine, I first claim combining with a reaping machine a self-acting weighing apparatus, for weighing the grain into any required quantity, to form sheafs or bundles of a uniform weight, as described, and

depositing the same upon the ground in readiness to be tied, whilst the reaping machine is drawn forward and cuts the grain—the said weighing apparatus being made adjustable so to increase or diminish the size of the bundles at pleasure: and this I claim, whether the weighing apparatus be made and arranged as described, or in any other way which is substantially the same, or whether combined with the aforesaid reaping machine, or any other of a similar character.

“ 2nd. I likewise claim the combination of the beat-holders *w*, *w*, with the inclined endless conveyor for holding the grain thereupon, whilst conveying it to the weighing and depositing apparatus, as aforesaid.” *Patent Office Report*, 1851, p. 122.

William Watson, E. Sabine Renwick, and P. Hill Watson, of Chicago, Illinois, grain harvesters and binders, May 13, 1851.—“ Having thus specified our improvements in harvesting machines, what we claim as our invention, and desire to secure by letters patent, is—

“ 1st. The method of raking and binding grain at one operation by the mechanism herein specified, or its equivalent, substantially as herein set forth.

“ 2nd. We claim the arms *m*, in combination with the levers *p*, by means of which the rake-teeth are alternately raised and depressed, as the rake is moved alternately in opposite directions by endless rake chains, which move continually in the same direction.

“ 3rd. We claim the method of adapting the binding apparatus to the length of the cut grain, by varying the respective positions of the cutting and binding apparatus, substantially as herein set forth; that is to say, by moving the front of the platform, with the cutting apparatus, backward or forward, or by moving the binding apparatus nearer to or further from the front of the platform, in such manner that the sheaf may be bound near the middle of its length, whether it be long or short.

“ 4th. The method of binding grain by the mechanical devices herein specified, or their equivalents, acting in connexion, and automatically, by motion derived from or dependent upon the movement of the machine to which they are attached.

“ 5th. We claim the cord finger (*b*,) operating substantially as herein set forth, by the aid of which the grain is encircled by the binding cord.

" 6th. We claim the tying forceps, or the equivalent thereof, operating in connexion with mechanism for encircling the grain with cord or band, substantially as herein set forth." *Patent Office Report*, 1851, p. 164.

Nicholas T. Allen, of Ludlowville, New York, grain harvesters, June 10, 1851.—" Having thus fully described my invention, what I claim therein as new, and desire to secure by letters patent, is gearing the operating parts of the machine from both the wheels, in combination with the arrangement by which portions may be driven by either, so as to equalize the driving power upon each, and thus to allow the machine to be much more easily guided and controlled." *Patent Office Report*, 1851, p. 184.

William H. Start, of Smyrna, Kent County, Delaware, grain harvesters, June 24, 1851.—" Having thus described my improved grain and grass cutter, what I claim as my invention, and desire to secure by letters patent, is—

" 1st. The standard to which the steering wheel is attached, constructed as herein described, so as to perform its own office proper, and also to adjust the cutter at the required height above the surface of the ground.

" 2nd. The discharging rake, which is moved, as described, in combination with the endless apron, for collecting and discharging the cut grain, as set forth." *Patent Office Report*, 1851, p. 191.

Aaron Palmer and S. G. Williams, of Brockport, New York, grain harvesters, July 1, 1851.—" What we claim as our invention, and desire to secure by letters patent, is the discharging the cut stalks and heads of grain from the platform *D*, by means of the combination of the rake *c*, with the lever *B*, and the co-operation therewith of the series of teeth *p*, *q*, on the face of the wheel *A*, and the inclined rail *d*, rising above the curved guard of the platform *D*, substantially in the manner herein set forth." *Patent Office Report*, 1851, p. 193.

William Jones, of Bradford, Vermont, harvesting machines, July 8, 1851.—" Having thus fully described the construction and operation of my grain harvester, what I claim therein, and desire to secure by letters patent, is the use of rotating cutters, in connexion with the rotating rake and teeth (*d*), operating substantially as described.

"I also claim the novel manner of gearing the horses, or animal power, under the machine, so as to conduct the grain over them and discharge it in a straight line in the wake of the machine, substantially as herein described and made known." *Patent Office Report*, 1851, p. 198.

William H. Seymour, of Brockport, New York, rakes to harvesting machines, July 8, 1851.—"What I claim as my invention, and desire to secure by letters patent, is the rake attached, for raking the grain from the machine without hand labor, constructed and operated substantially as described." *Patent Office Report*, 1851, p. 200.

Sylvanus Miller, of Urbana, Ohio, rakes to harvesting machines, July 15, 1851.—"Having thus described the nature and construction of my harvesting apparatus, what I claim therein as new, and desire to secure by letters patent, is the guide, (*p, q, r, s,*) arranged, as described, in connexion with the tilting roller (*u,*) for the guidance of the rake in a path similar to that which it would receive from the human hand, by which it removes periodically the grain or grass from the bed, and frees itself by the retraction of the teeth of the rake endwise." *Patent Office Report*, 1851, p. 203.

John H. Manny, of Waddam's Grove, Stephenson County, Illinois, mowing machines and harvesters, September 23, 1851.—"What I claim as my invention, and desire to secure by letters patent, is hanging the cutter bar of a reaping machine to the side of a triangular frame, in such manner that neither extremity of the cutter shall be liable to sag below the other extremity, as herein set forth." *Patent Office Report*, 1851, p. 245.

AUSTRIAN PATENT.



THE following description of a mowing machine (with the illustrative drawings in Plate XXII.) is extracted from the "*Description of Inventions and Improvements for which Patents were granted in the Austrian States and whose term has expired.*" Vol. iii. page 27, published at Vienna, 1845.

Patent of Henry Springer, in the Royal Imperial Corps of Artillery, Vienna, for the invention of a mowing machine. Issued 9th August 1839. Prolonged in the year 1840 for one year. Expired in the year 1841.—“This mowing machine, of which Fig. 13, is an elevation and Fig. 14, a plan, carries a number of horizontal reaping-hooks *r*, on a vertical spindle *p*. This spindle, together with the knives, is put in motion by an endless band *o*, which runs round a groove in a pulley attached to the cart-wheel; and by this means every description of plant that may happen to stand in the way will be cut down. It is evident, therefore, that the whole machine consists of two principal parts, viz.,—first, a wheel-barrow, which, with the exception of some trifling alterations, to be described hereafter, resembles one of the ordinary kind; and, secondly, the mowing apparatus itself, which may be either permanently connected with the wheel-barrow, or arranged in such a manner as to be easily detached from it (by means of bolts and bands), in case the latter be required for other purposes. The shafts, the frame-work, and the wheel with its bearings are of the usual construction. The improvements which relate to the wheel-barrow consist chiefly in the removal of all weak and fragile parts, and the facility with which the cart may be taken to pieces and put together again when it is required for other uses. The shafts are

longer than usual, by which means the weight is more equally balanced, as the centre of gravity falls nearer the axis of the wheel. The shafts may be either straight or curved, and serve at the same time as the frame-work of the mowing apparatus. The two prolonged shafts (more or less curved) which carry the mowing apparatus may be shaped in such a manner that, if connected by cross-bars, they assume the form of a ladder, and can be used as such. But should the cart or wheelbarrow be used merely for transporting a load, the disposition of the shafts presents the advantage, that this load is equally distributed on either side of the axis, whereby the effort of moving a load is diminished. The wheels or pulleys for giving motion to the mowing apparatus may be made of wood or, preferably, of metal, and the connexion effected either by means of cords, straps, bands, or chains.

The beam s''' , which is bolted to the mowing-frame, together with the pulley R , serves for keeping the endless band in tension; and to effect this, the beam can be shifted along the slots s , s' , s'' , if the band should become slack. A less degree of tension may be produced also by the wedge q .

RUSSIAN REAPING MACHINE.



IN 1831 there appeared in the Quarterly Journal of Agriculture, vol. iii. page 185, the following notice of a Russian Reaping Machine, extracted from the *Journal de St. Petersburg*:—"M. P. Häüy, of Odessa is about to publish the prospectus of a machine of his invention, which ought to draw the attention of farmers. 'The desire of rendering an important service to agriculture,' says M. P. Häüy, 'has induced me to attempt the invention of a machine for reaping corn. It is as simple in its construction as can reasonably be expected, seldom requires repairs, and an intelligent peasant will very soon understand its whole mechanism, and work it without the least trouble. This machine is of such a nature that, with the assistance of two horses, one man, and two boys, a field of a *dessiatine* in extent may be reaped and put in sheaves within ten hours. It costs about 500 roubles. If the season is sufficiently dry, it may be used in the night-time by the light of lanterns.' " *Journal de St. Petersb.* 23 Avril, 1829.

SINCE the preceding part of this Appendix has been in type, a more detailed account of Mr. Ridley's machine, noticed at page 46, has been found in Chauncy's *Guide to South Australia*, page 38, (London, 1850,) and is as follows:—

“ The large amount of grain grown in South Australia, in comparison with the number of its inhabitants, rendered it difficult to find hands to cut it, and the prices asked were so high, that several farmers found it suited them better to turn their cattle into the standing corn than pay for the reaping of it at the rates then demanded. As a remedy for this difficulty, Mr. Ridley, an ingenious colonist, has invented a reaping-machine which has been admired by all who have seen it working. We subjoin a description of it, as given by Capt. Grey, the late Governor of the province, and quoted by Mr Wilkinson in his excellent work on South Australia:—

“ . . . this machine reaps, thrashes, and winnows, all at the same time, and this at the rate of nearly an acre an hour,—the machine requiring to be attended by two men.

“ ‘ It is something like a cart, pushed forward by two horses, instead of being drawn. In front of this machine is a very large steel comb, which is pushed forwards by the horses, and seizes the straw of the wheat as an ordinary comb seizes hair. As the machine moves forward, the straw is, by the motion, drawn through the comb, until the head, or part containing the grain, is caught in the comb, and dragged upwards towards the mouth of the machine.

“ ‘ From the peculiar dryness of this climate, the wheat sheds (as it is termed) very easily; that is, the corn or grain falls very readily out of the husk; and indeed so much so, that wheat cannot be reaped here in the usual manner, without considerable loss from the shedding.

“ ‘ As soon, therefore, as the head of the wheat is caught in the comb, the grain is, as it were, combed out, and falls down the comb to the mouth of the machine; that part of the head of the wheat which does not get through (which is too fine to admit it until the

grain has fallen out) is ultimately dragged up to the mouth of the machine, when it is knocked off by an apparatus like that of an ordinary thrashing machine; and the wheat is then thrashed in the same manner as in other thrashing machines, whilst the rapid advance of the machine creates a strong draught, by the aid of which the corn is winnowed. The straw is left standing; so much of it as is required for manure, &c., is mown; and the remainder is burnt.'

"Considerable improvements have recently been introduced in the mode of working this machine; it is now drawn in the same way as a cart, and has become extensively used in the colony. It is also a profitable article of exportation to the other colonies. Mr Ridley has been honoured with the patronage of the Queen and Prince Albert."

Accounts of two other reaping machines have also been subsequently met with in a work, entitled *Recueil de Mécaniques et Description des Machines relatives à l'Agriculture et aux Arts*, by Person de Berainville, Paris, 1802. Each of these instruments is supported on one wheel only, and is forced forward by a man in the manner of an ordinary wheel-barrow. One of these instruments acts like those shown in the "Table illustrating the Forms and Movements of the Cutters of Reaping Machines," under the head "Rectilinear Motion—advancing only;" the other acts in the manner of those shown under the head of "Circular Motion—continuous and advancing;" and so much do they resemble, in all particulars, what has already been shown, that it was thought undesirable to detain the publication of this book, by waiting to have them copied in full.

THE END.

A.D. 1786.
PITT.

PL. I*

Fig. 1.

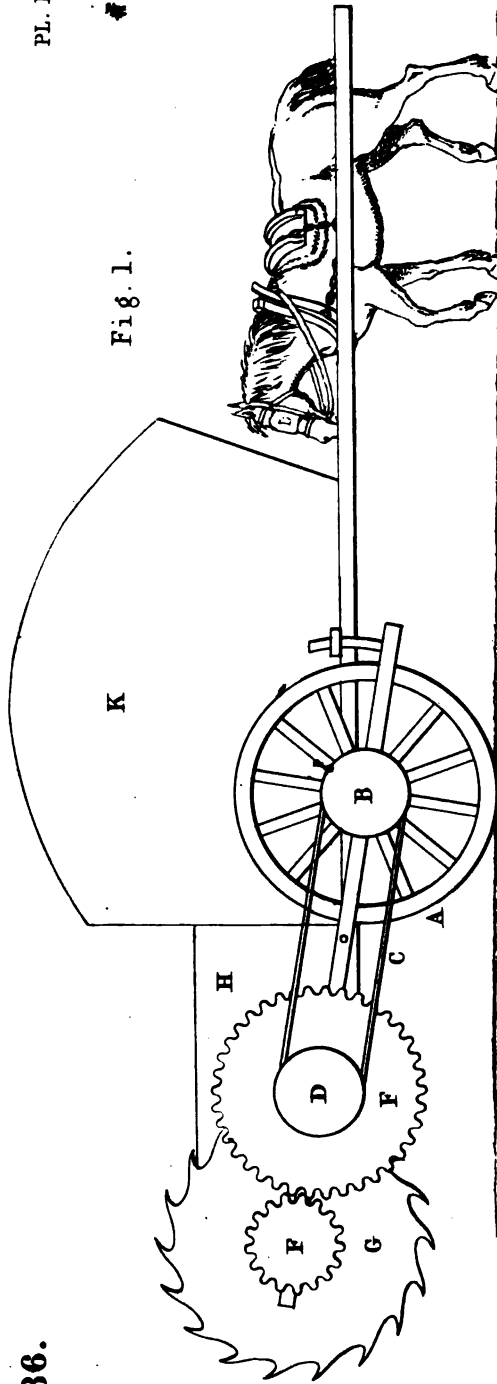
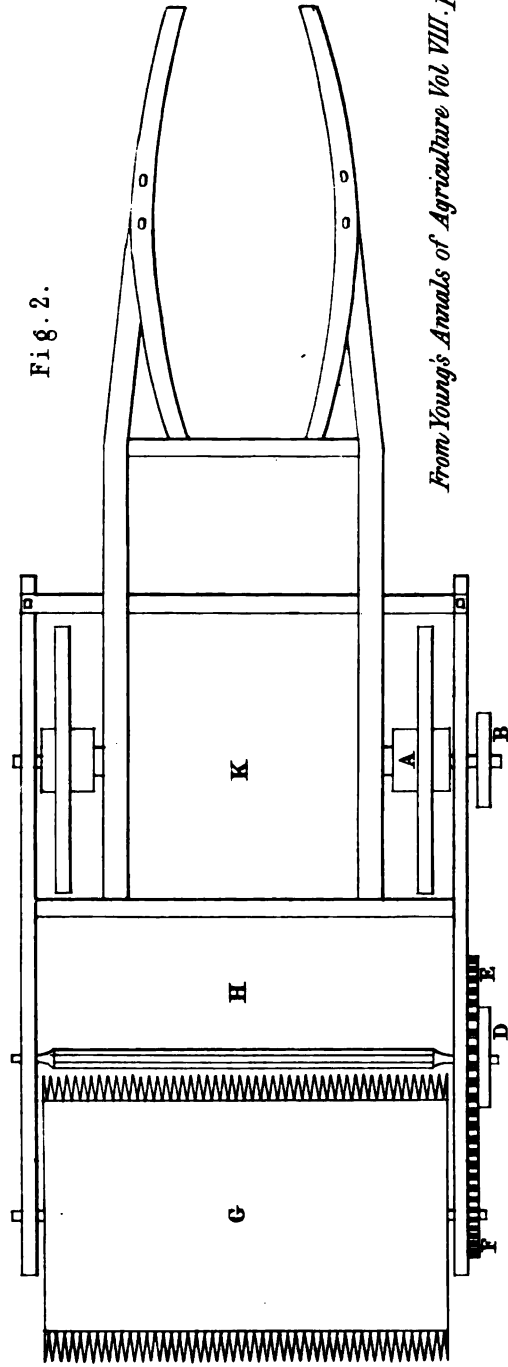


Fig. 2.



From Young's Annals of Agriculture Vol VIII. p. 161.

A.D. 1800 *an View*
PLU

PL. III.
(1 Sheet)

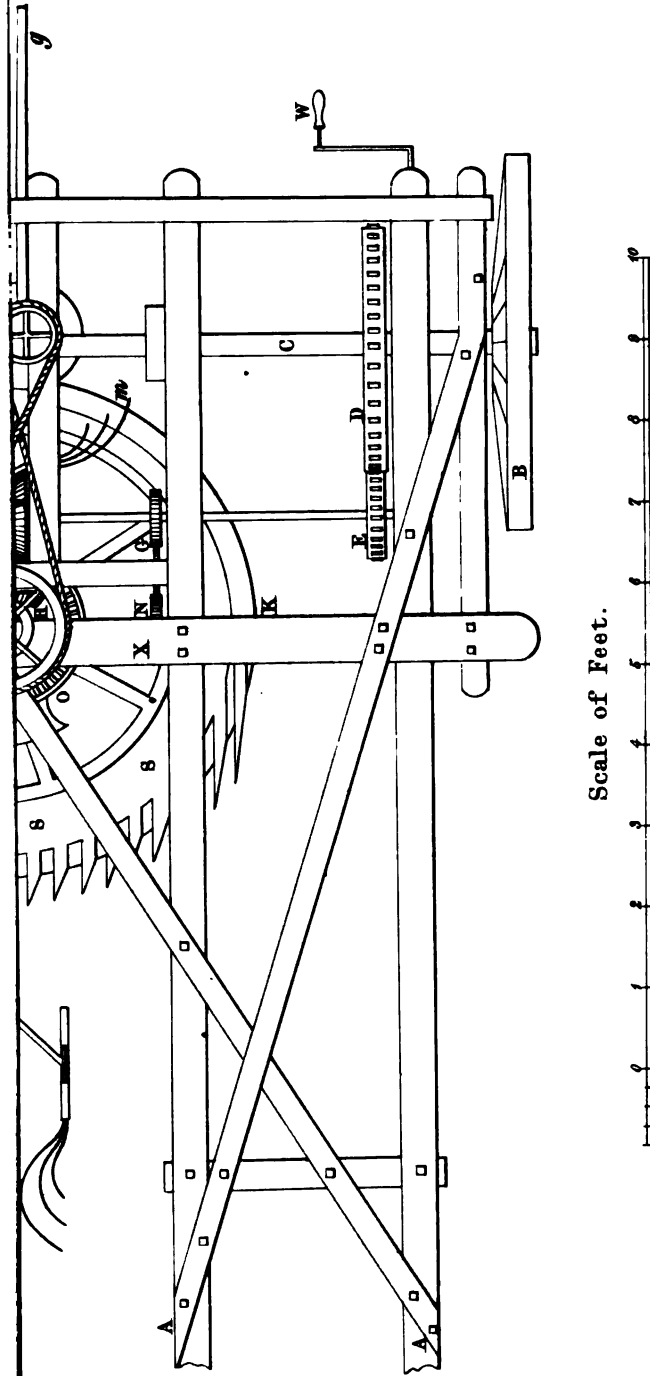
Elevation. (one wheel being removed)

*Drawing, as suggested from the
description in the Specification.*

J.R. Jobbins.

A.D. 1806.
GLADSTONE .

PL. IV.

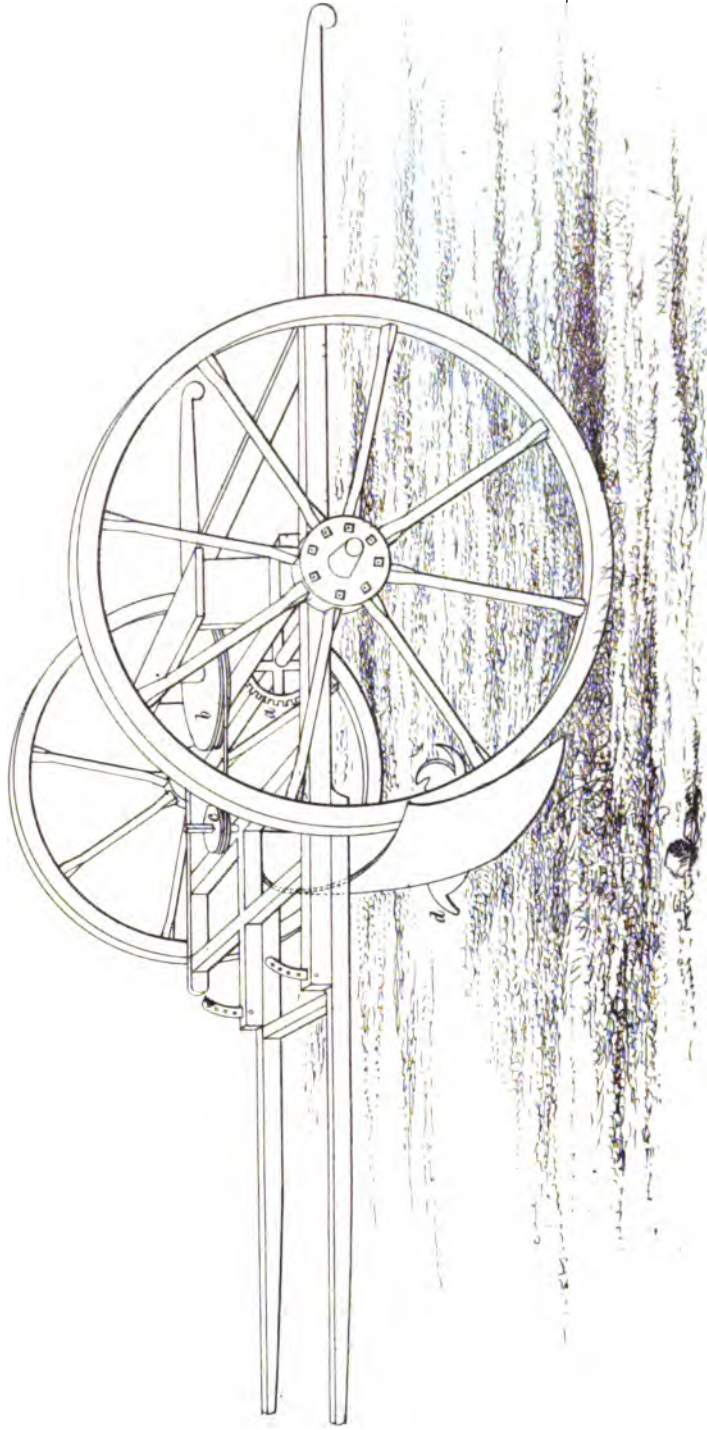


From Brewster's Edinburgh Encyclopedia Vol. 1. p. 262. pl. 8.

J.R. Johnson.

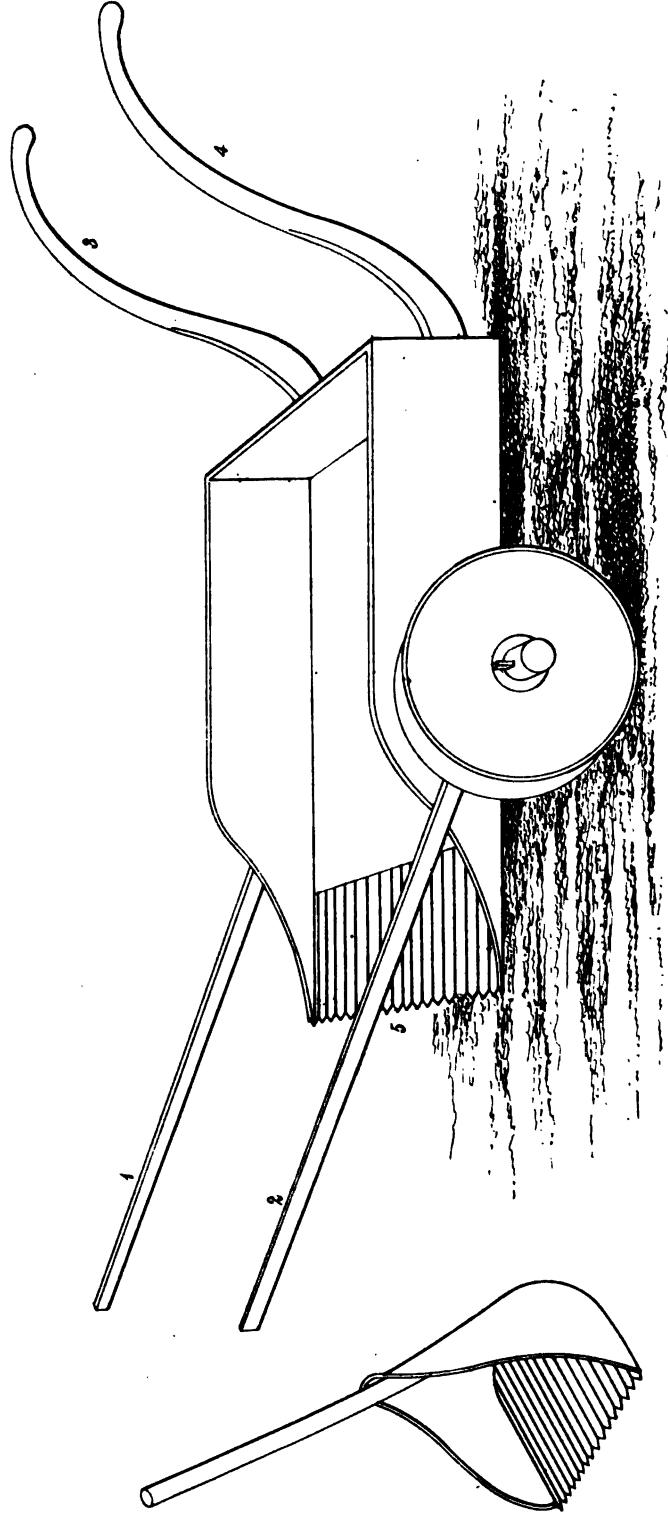
**A.D. 1807.
PLUCKNETT.**

PL. V.



A.D.1807.

PL. VI

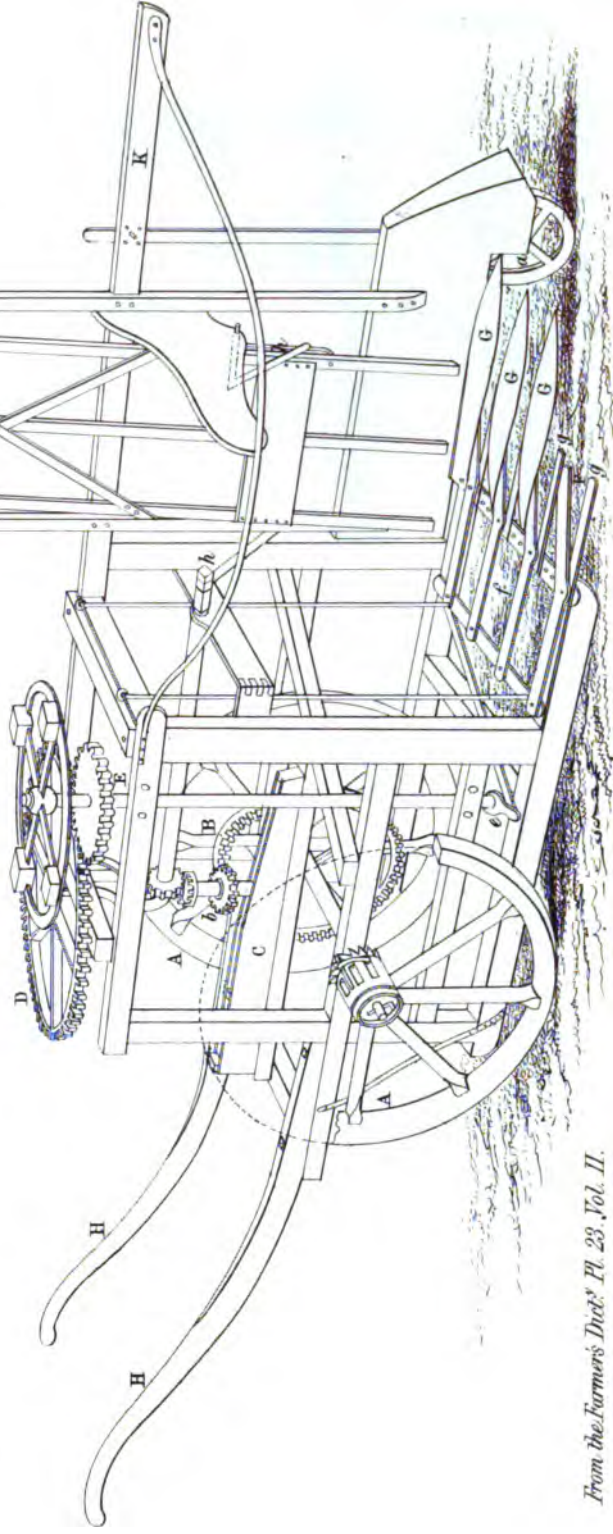


1. 2. The shafts 4 ft long & 3 feet asunder — 5. The fingers or teeth are 13 inches long
3. 4. The handles 3 feet long & 20 in. asunder — The wheels are 16 inches in diameter

**A.D. 1807.
SALMON.**

PL. VII.

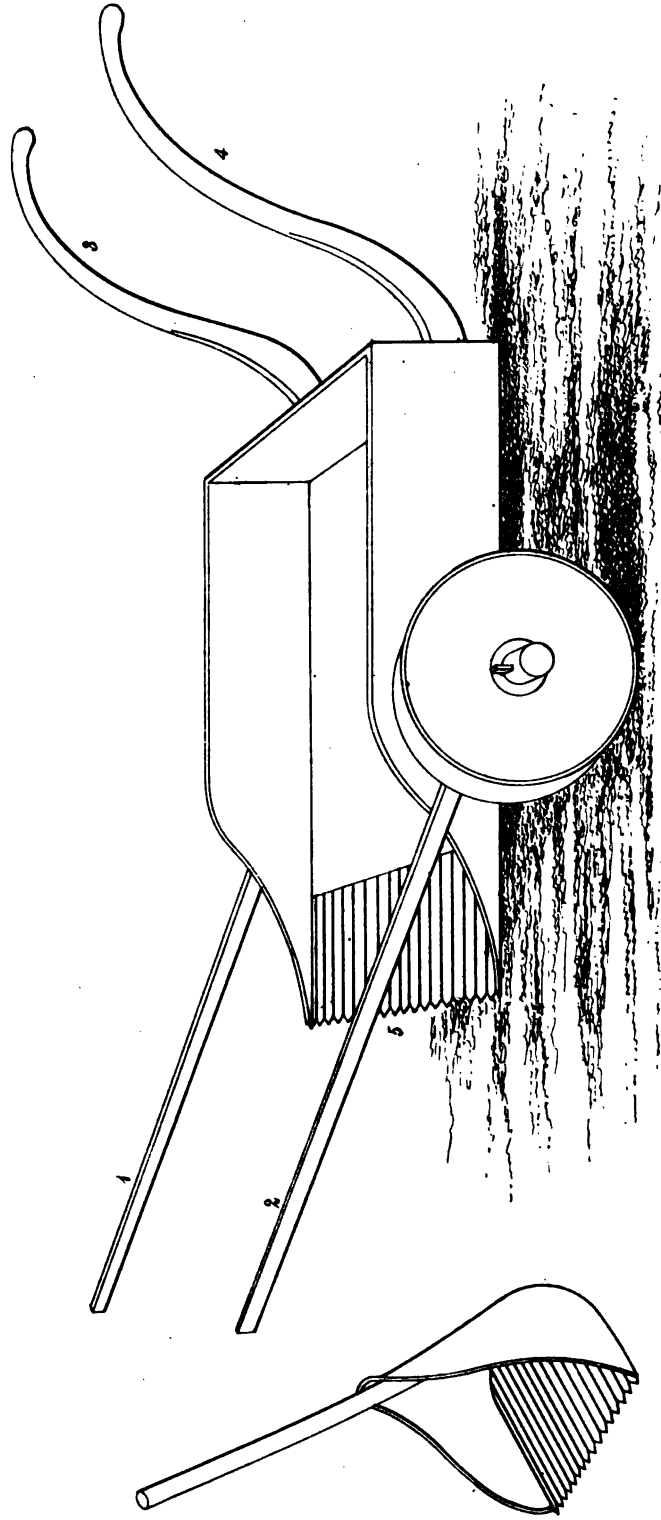
- AA Two large Wheels on which the Machine runs, they are fixed to their axle by ratchet wheels so as not to turn it when the Machine is drawn backwards.
a. A small wheel which regulates the distance of the cutters from the Ground.
B Cog Wheel on the main Axis turning a pinion b, which is thrown out of gear by withdrawing a wedge C, when the Machine is to be wheeled along without cutting.
D Large Cog Wheel on the Axis of b turning a pinion E, whose crank e moves the tails f of the shears F.
G Pieces of Iron Plate covering the fixed blade g of the shears they gather the Corn to the shears.
H Handles by which the Machine is wheeled.
K A projecting bar which separates the standing Corn from that to be cut.
M A rice moved by a large crank h it passes over the shears and delivers the Corn they have cut upon the Ground clear of the Machine. An Iron Plate covers the tails f of the shears.



From the Farmers' Dict^y Pl. 23. Vol. II.

A.D.1807.

PL. VI



1. 2. The shafts 4 ft long & 3 in diameter — 5. The fingers or teeth are 13 inches long
3. 4. The handles 3 ft long & 20 in diameter — The wheels are 16 inches in diameter

PL. IX.

A.D. 1811.
KERR.



From the Encyc. Edinensis. Vol. 1.

J.R. Johnson

A.D. 1815

THE ...

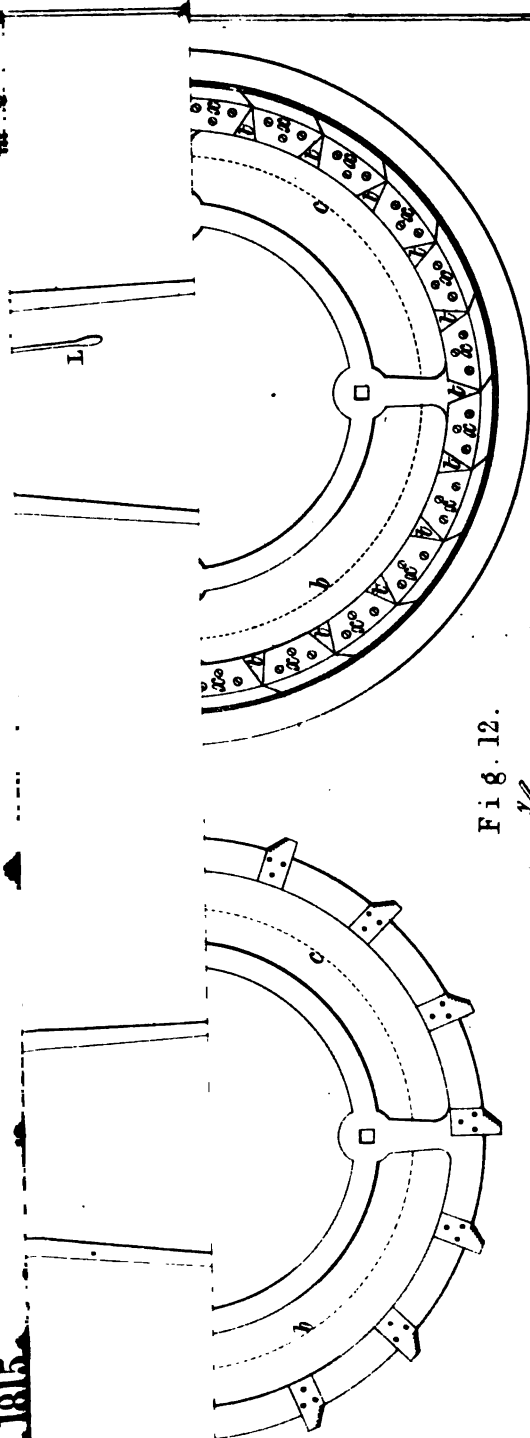
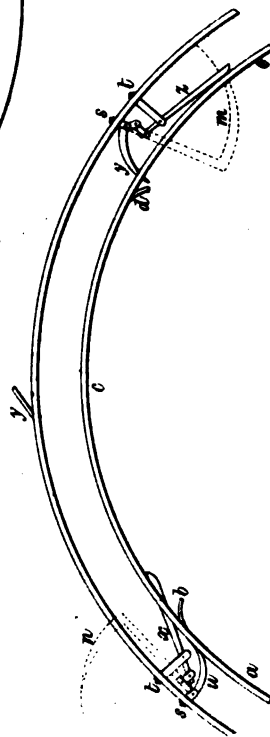


Fig. 12.



From Brewster's *Edin. Ency.* Vol. 17. Pl. 478 & 479.

J.R. Johnson

A. D, 1815.
GLADSTONE.

PL XL.

Fig. 13.

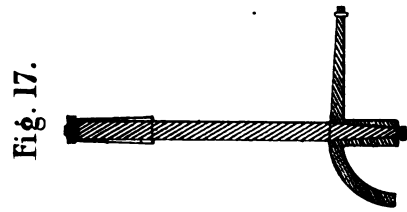


Fig. 17.

Fig. 16.

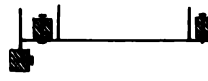
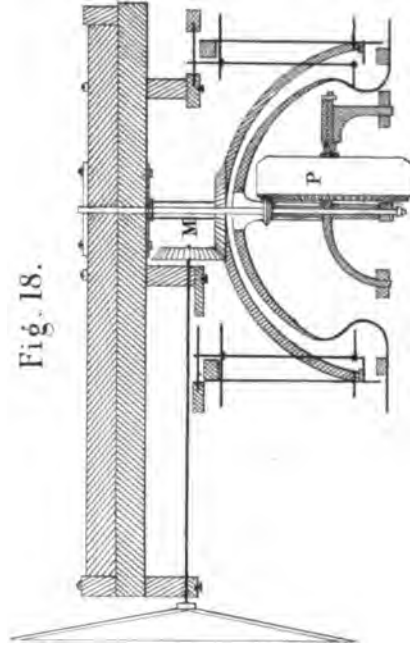


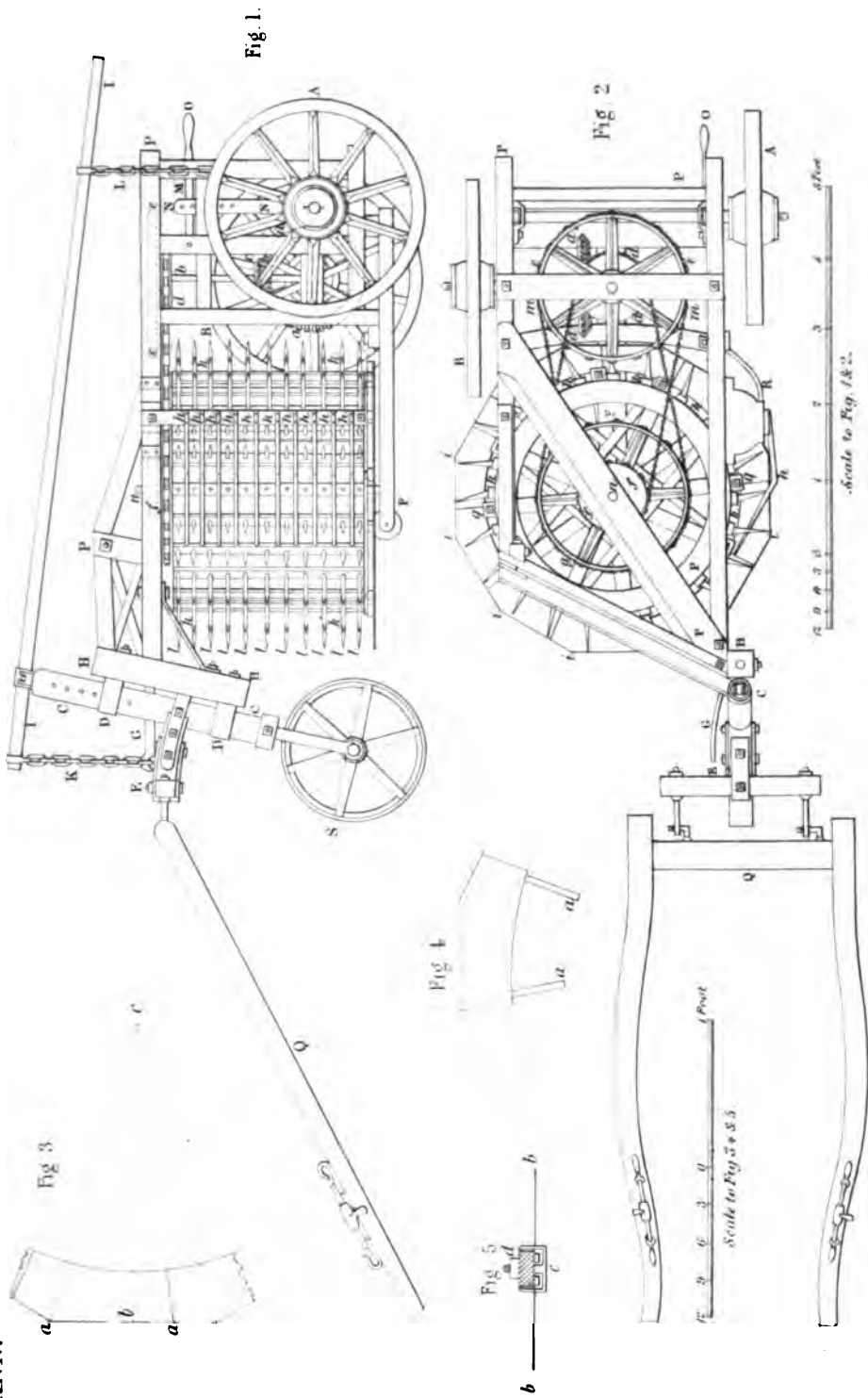
Fig. 18.



From Brewster's Edin. Enc. Vol. 17. P. 479. 1830.

J.R. Jobbins.

A.D. 1820.
MANN.



Journal of Agriculture, Vol. 4, p. 250, Pl. 1.

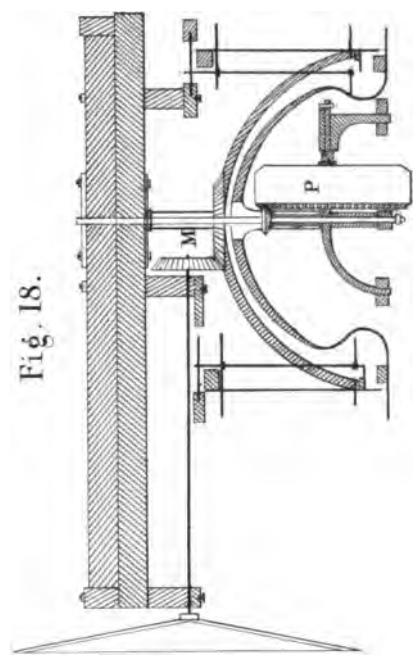
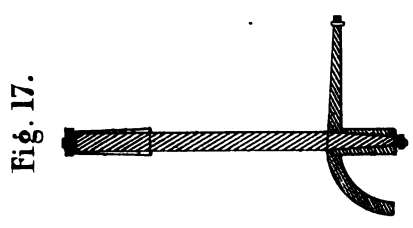
J.R. Johnson



A.D, 1815.
GLADSTONE.

PL. XI.

Fig. 13.

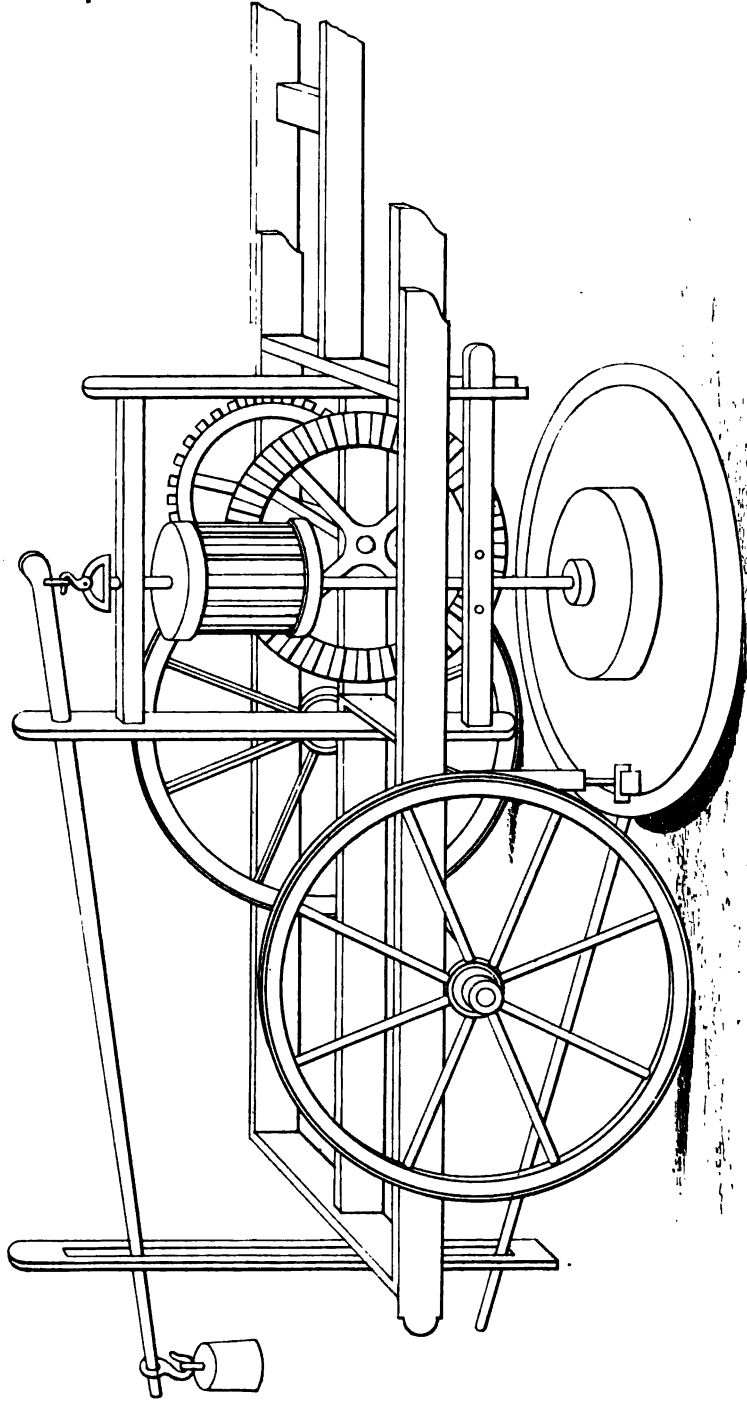


From Brewster's Edin. Enc. & Vol. 17. P. 479. 1830.

J.R. Jobbins.

A.D. 1823.
BAILEY.

PL. XIV.



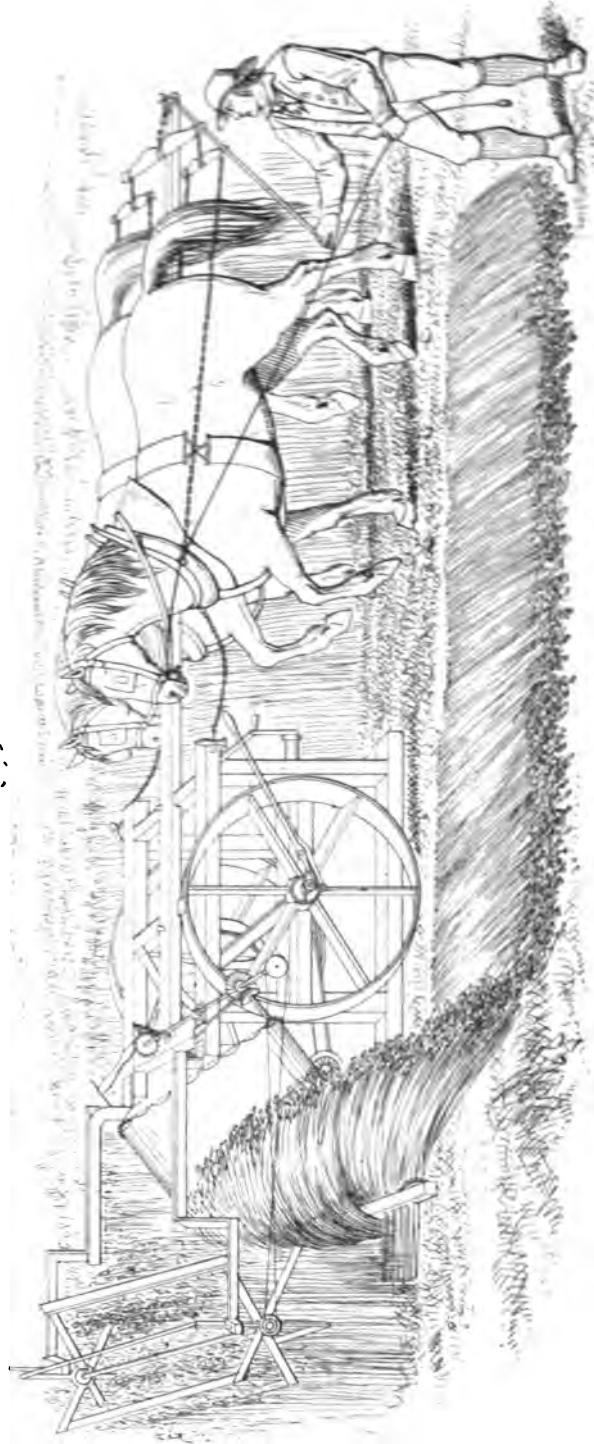
From the Mechanic's Mag. Vol. 1. p. 145.

J.R. Jobbins



A.D. 1826.
BELL.

Pl. XV

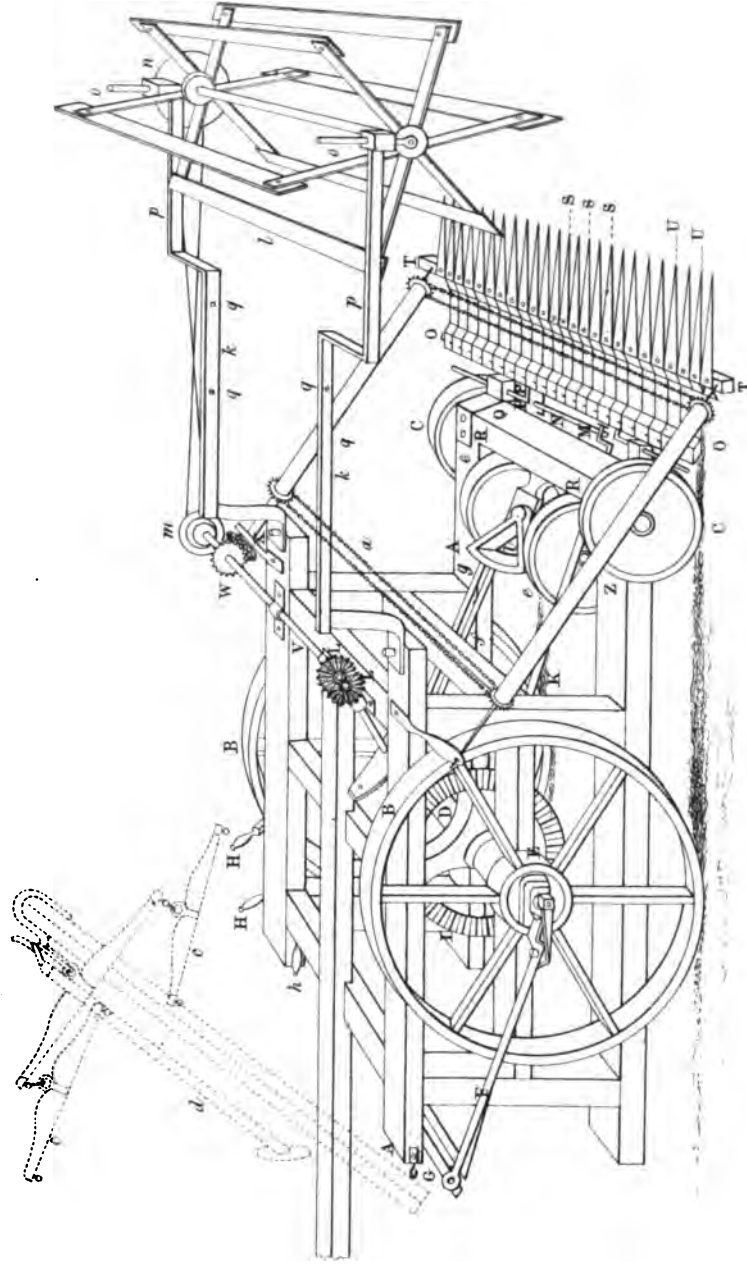


From Loudon's Encyc. B IV P 423

1 P 423

A.D. 1826.
BELL.

PL. XV.



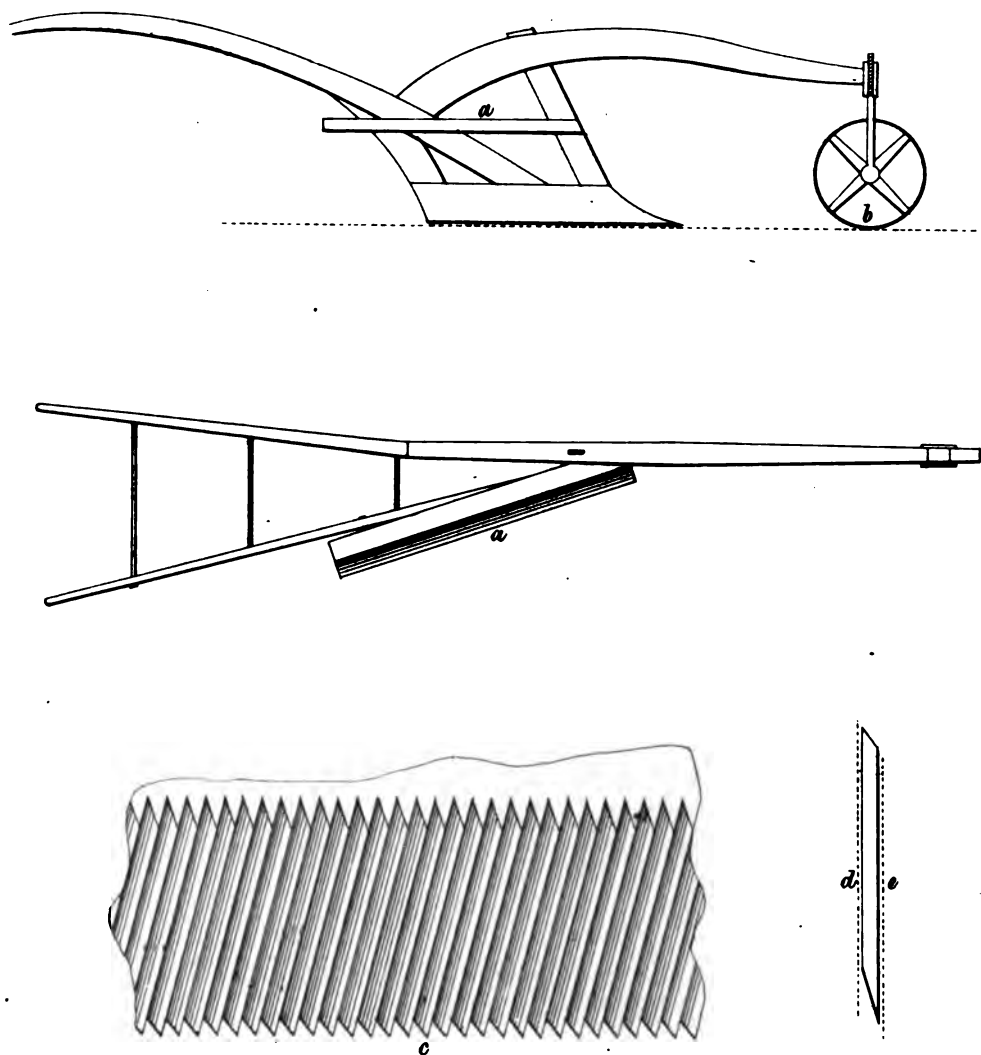
From Loudon's Encyc. of Agriculture p. 425.

J.R. Jobbins.

A.D. 1826.
GLADSTONE.

PL. XVI.

Fig. 378



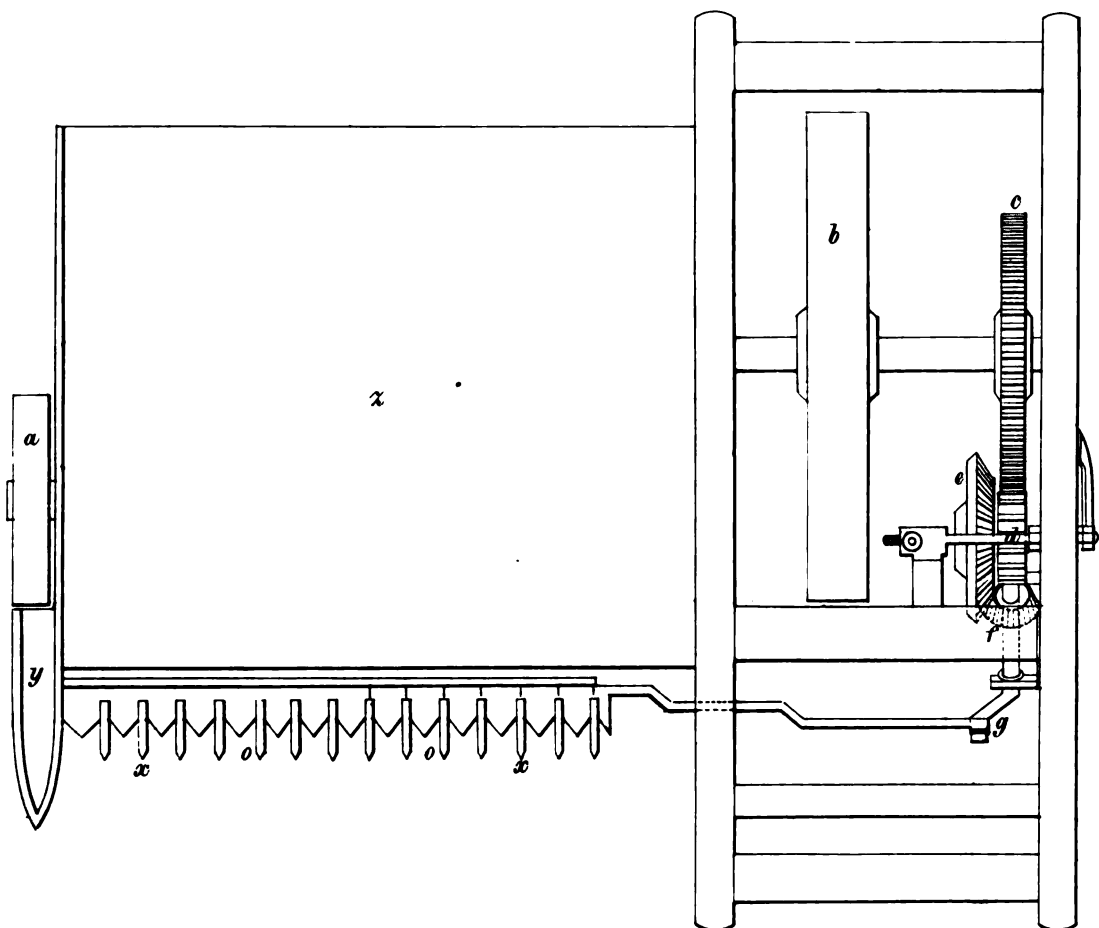
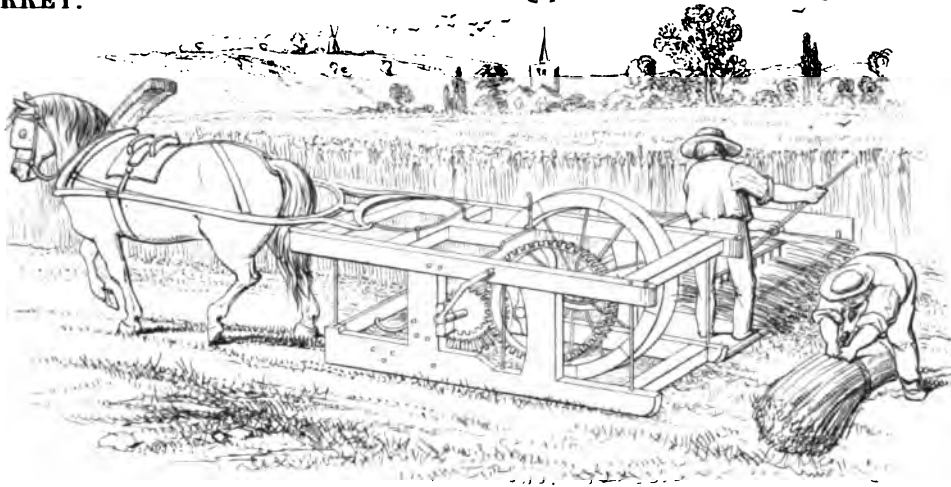
From Loudon's Ency.^o of Agriculture. p. 427.

J.R. Johnson.



A.D. 1851.
GARRET.

PL. XVII.

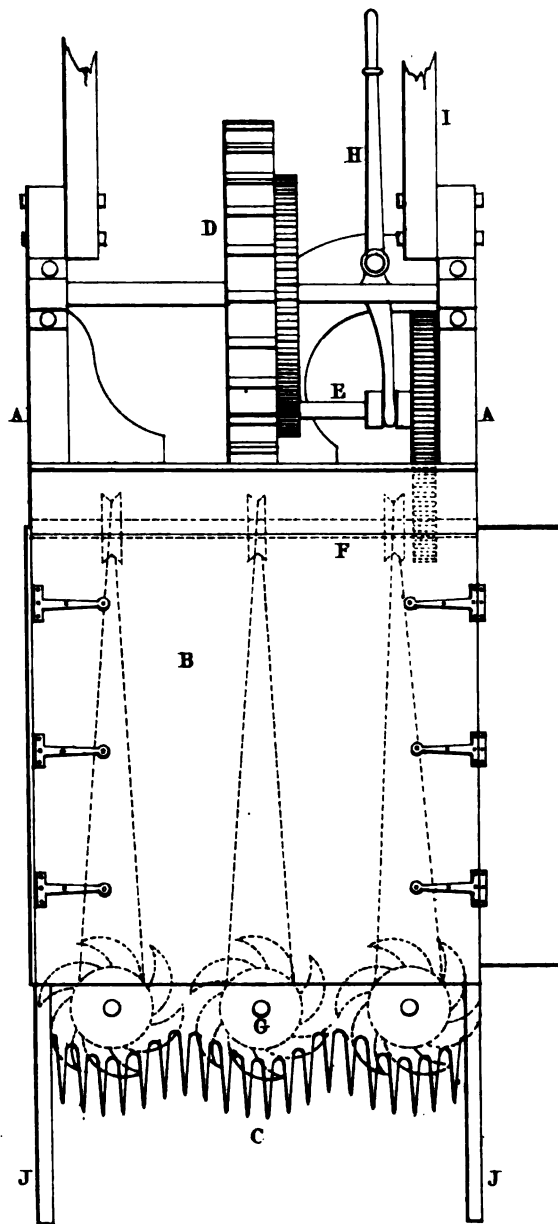


J.R. Jobbins.



A.D. 1852.
MASON.

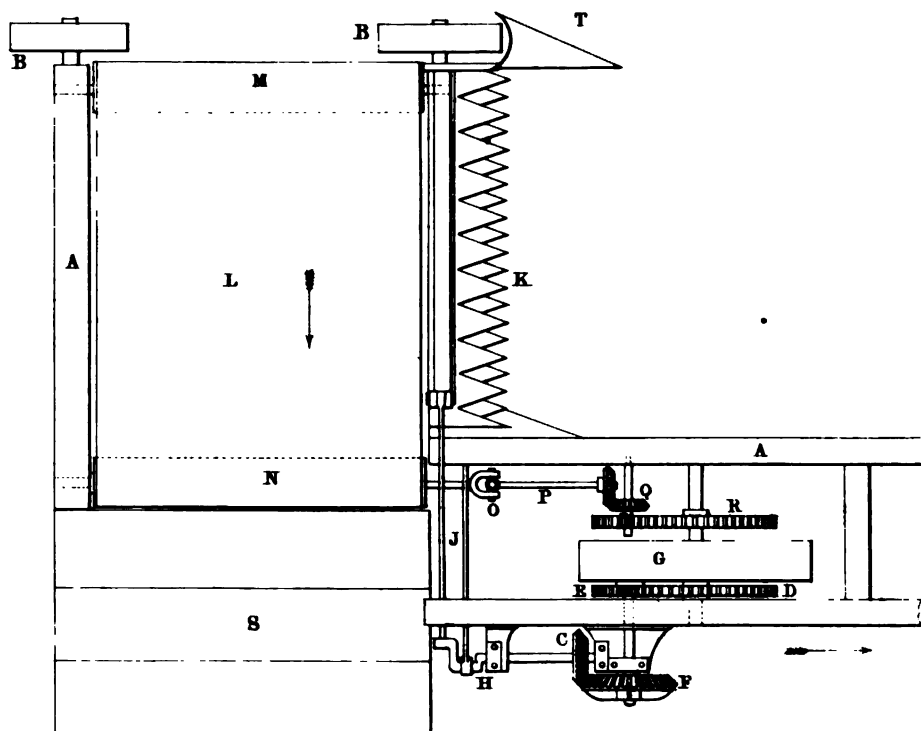
PL. XVIII.



J R Jobbins

A.D. 1852.
WRAY.

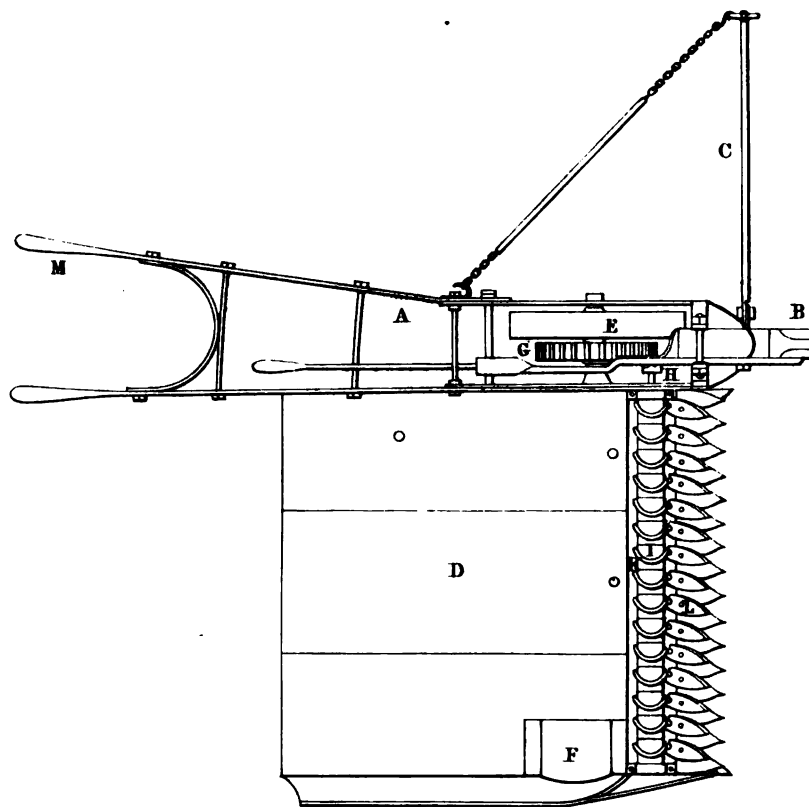
PL. XIX.



From the Practical Mechanics Journal Sept. 1852.

A.D. 1852.
HARKES.

PL. XX.



From the Practical Mechanics Journal Sept. 1852.

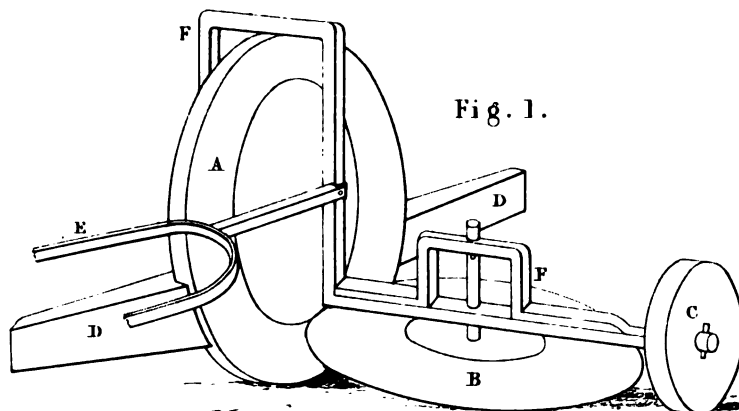


Fig. 2.

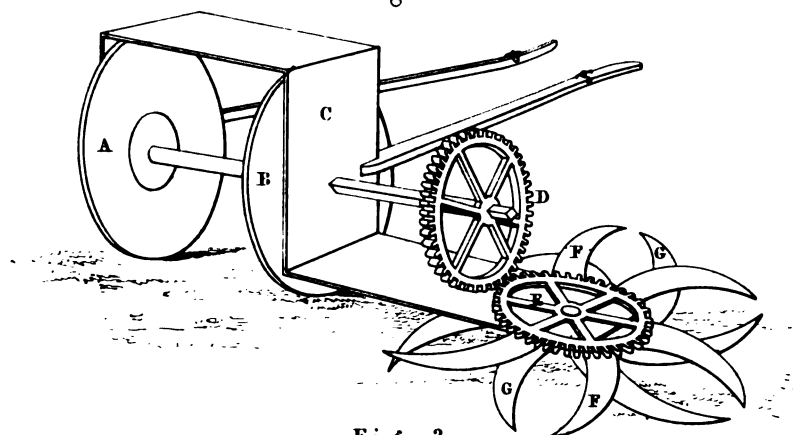
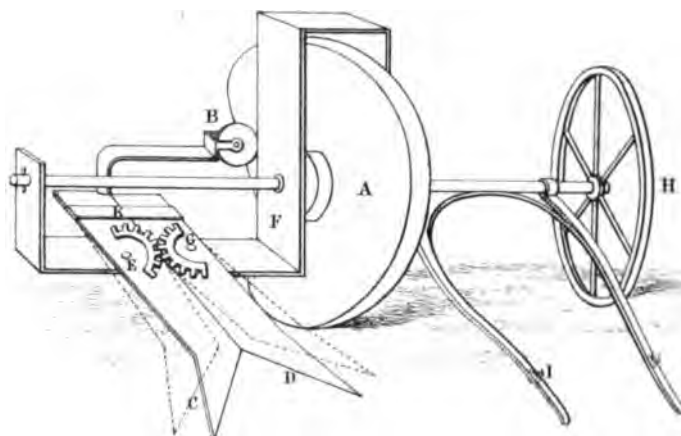


Fig. 3.



From the Practical Mechanics Journal Dec. 1852.

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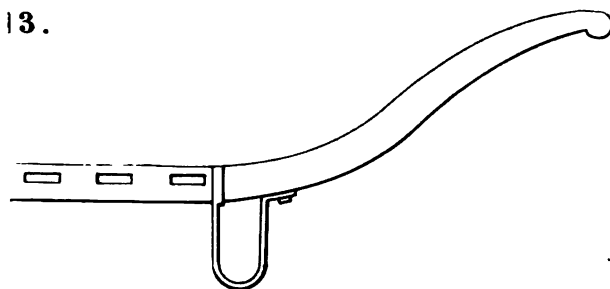
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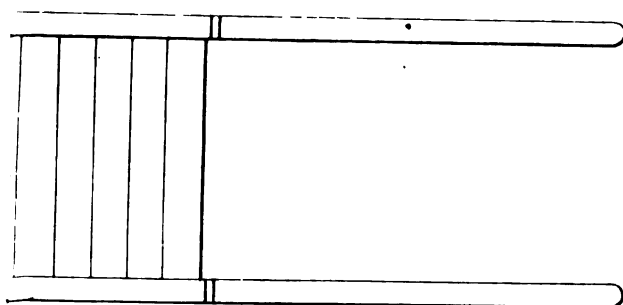
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PL. XXII.

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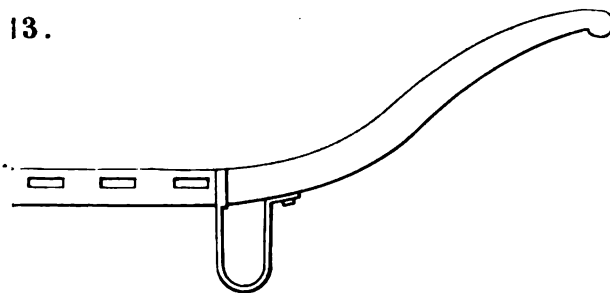
J.R. Jobbins.

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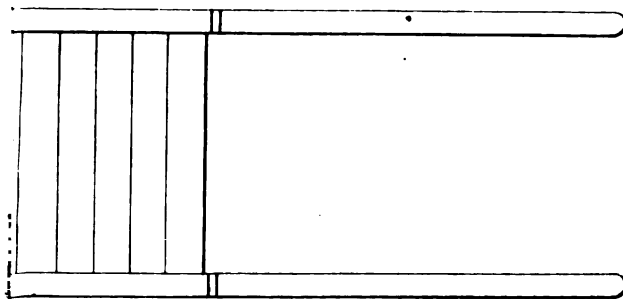
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Pl. XXII.

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J.R. Jobbins.



